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THE FOUNDRY TRADE JOURNAL IS THE OFFICIAL ORGAN OF THE INSTITUTE OF BRITISH FOUNDRYMEN; THE WELSH ENGINEERS' AND FOUNDERS' ASSOCIATION, AND THE FOUNDRY TRADES' EQUIPMENT AND SUPPLIES ASSOCIATION.

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Telephone: Central 1893. Telegrams: CIRA.
The B.C.I.R.A. Scottish Laboratories are:—
Foundry Technical Institute, Meek's Road, Falkirk (*Telephone 3391*).

Forthcoming Events.

SEPTEMBER 6-12.
International Association for Testing Materials:—First International Congress at Zürich.

SEPTEMBER 10-26.
Shipping, Engineering and Machinery Exhibition:—To be held at Olympia, London.

SEPTEMBER 12-27.
International Foundry Congress and Exhibition, at Milan.

SEPTEMBER 13-18.
Institute of Metals:—Autumn meeting at Zürich.

SEPTEMBER 23-30.
British Association:—Centenary meeting in London.

SEPTEMBER 29-OCTOBER 2.
Iron and Steel Institute:—Autumn meeting at Swansea.

The New Foundry Education Scheme.—I.

The approach of the winter season and the issue of programmes of the evening technical institutes reminds us again that this winter will see the active starting of the ambitious scheme for foundry education, sponsored by the Institute of British Foundrymen. It is not too much to say that the scheme is known to all the technical schools, and only the provision of students is required to make the scheme a success. We therefore appeal to all grades in the industry to take advantage of it. Employers know well how difficult it is to fill vacant posts with men of the right training. They can do much by offering encouragement to those engaged in the foundry to take the classes. The knowledge that the employer is really interested in the scheme will act as a valuable stimulus and show prospective students that it is well thought of. Some firms make very far-sighted provision for those attending part-time classes, offering in some cases to refund fees paid at the satisfactory termination of a session's work, prizes, provision for text-books, wage advances, or time off in the day once a week to attend where day courses are in operation, and so on. The encouragement takes various forms, and is often on an organised basis in the larger firms, but it yields results out of all proportion to the expenditure. Many students feel discouraged from attending classes during trade depression, but that is frequently the time when most leisure is available for study, and the utmost use should be made of it.

The two schemes are wide enough in scope to offer something to everybody, and to those older men who feel disinclined to start over again we would say that to take the certificate early is to get in on the ground floor, as the stockbrokers say. The Papers are bound, as the years go on, to become harder as the machine for providing the instruction becomes more efficient. For the craftsman there is the scheme run in conjunction with the City and Guilds of London Institute. This scheme is covered by an official syllabus for two examinations, either or both of which may, of course, be taken. One is patternmaking, and the other is foundry science and practice. The patternmaking course covers two years to the Intermediate examination and two years to the Final examination. Candidates under 21 must furnish evidence of suitable preliminary education, such as any youth may obtain between the ages of 14 and 16 at any evening technical institute. Two three-hour Papers will be set at each examination, on patternmaking practice and on drawing, geometry and patternmaker's calculations. The final certificate will count as a full technological certificate of the City and Guilds of London Institute, and both Intermediate and Final certificates will be countersigned by the President of the Institute of British Foundrymen, the certificate being national in character. We propose to revert to the foundry course and the other grade of certificate in our next issue.

The "Dinta" System.

We have never been too sure exactly what the "Dinta" system stood for. We were cognisant that it organised training schools for entrants into industry. We knew something of its activities in the direction of vocational-suitability testing, but until the receipt of Mr. Marsdon's article we were ignorant of the fact that it is an industrial-cultural effort which is permeating German industry. We learnt with interest that it has 10,000 lads being trained under its auspices. Now, we have to ask ourselves whether British industry requires such an organisation superimposing upon it. In this matter, we have made up our minds—perhaps rather hastily—that nothing of the kind is needed, because of the basic difference in the temperament of the two nationalities. Quite a number of Germans imagine that the British habit of "week-ending" is carried out on an organised basis, instead of which it just happens! Thus, too, the objects sought by the "Dinta" movement will just "happen" in Great Britain as an ordinary event in evolution. For instance, the giving of manual training to clerks, in order that they may better understand the work they will be called on to do, seems superficially desirable, yet the average British office employee does somehow acquire a concrete and workmanlike appreciation of the objects and articles, the names of which he has to write in his books and deal with in correspondence. The fact that letters received from Germany on the most trivial matters are signed by two of their most important executive officers discloses a situation incompatible with British ideas of organisation. Here a junior clerk is empowered to write and sign letters about the smaller details of business, leaving the heads of the organisation free to concentrate on matters of major importance.

Our final thought is that the "Dinta" is a bunch of contradictions. It appears to us to be an organisation charged with the task of inducing individuality and character in the personnel of industry, whilst it performs for industry many of the activities which are expected from leaders of character and individuality. In other words, it is an excrescence consequent upon rationalisation, cartelisation, and all the other "isations" to be associated with German industry, to restore some of the human influences which they have destroyed, *but by utilising exactly the same nation-wide co-operative procedure.*

Correspondence.

[*We accept no responsibility for the statements made or the opinions expressed by our correspondents.*]

Economics Again.

To the Editor of The Foundry Trade Journal.

Sir,—Perhaps I may direct your attention to another, and, probably, not unimportant, aspect of the wages problem discussed in the editorial of your August 27 issue. If I have not misunderstood you, a fair paraphrase of your thesis would appear to be: "The cost of living has decreased, *ergo* money wages should decrease proportionally."

Now, whilst I have not available data in the way of comparative statistics to give concrete evidence for my statement, I do not think it will be disputed that, in the last ten years, say, or even in the last five, owing to improvements in processes, new types of machinery, reorganisation, rationalisation and such like, the output per worker has greatly increased. This increase has not, of course, been uniform throughout all trades and industries, nor even within any one branch of industry. In the foundry trade, for example, we know of certain sections where the output per worker has been increased many times, whilst in other sections the difference is very slight.

Sufficient is it, for our present purpose, that, taking industry as a whole, the output per unit of labour cost has increased, and, consequently, the prices of the resulting products decreased, which, in turn, is reflected in the lower cost of living.

Hence the proposal to reduce money wages in proportion to the reduction in the cost of living has this discouraging result; it at once cancels out all the efforts that you, as the editor of a progressive trade and technical journal, I as a p.b.f.m. (perhaps "Marksman" will elaborate the abbreviation), together with many thousand other technical and works executives, have been making over these many years to improve the efficiency of industry. Not to mention the fact that we render completely void our argument with the more short-sighted trade union officials, that the introduction of labour-saving schemes and devices, by cheapening the cost of goods, will create a greater demand; since the very thing we are depending on to give this greater demand—the greater purchasing power from the existing money wages—it is now proposed to lop off.

Certainly I do not suggest that the reduction in the cost of living in recent years is completely accounted for by increased productive efficiency. Up to the time of the return of the £1 to its former gold value, we know that, as far as this country at least was concerned, a part of the reduced cost of living was due to monetary deflation. Moreover, since then, there have been the effects of the sterilisation of gold stocks in New York and Paris, and similar factors, which, it is believed, have led to the deflation of gold values.

In so far as the reduction in the cost of living is due to these items just mentioned, then, taken at their face value, the arguments in favour of corresponding wages adjustments apply.

But the real problem is, what proportion is the reduction in the cost of living due to monetary causes, and what proportion to increased productive efficiency?

If we are not careful in this distinction we shall be throwing the baby away with the bath water. Probably the baby is already half-way down the hole—hence our present difficulties. To develop this point further, however, would take up too much of your valuable time and lead too deeply into the labyrinthine paths of monetary policy, dumping, tariffs and such like.—Yours, etc.,

Wenlock Savage.

105, Bleakhouse Road,
Quinton, Birmingham,
August 31, 1931.

Growth-Resisting Irons.

To the Editor of The Foundry Trade Journal.

Sir,—The abstract on page 114 of your issue of August 20 on growth-resisting cast iron for high temperatures, taken from a recent Paper by Mitsche and Keil, will be recognised by those who have followed recent developments as referring to the growth-resisting and scale-resisting properties of high-silicon cast irons. This Paper confirms the work carried out by the Cast Iron Research Association during the past few years on the properties of the high-silicon heat-resisting irons, now known as "Silal" irons. A footnote in the above German Paper, not reproduced in your abstract, refers to British Patent 323,076, which was taken out by this Association in 1928, and this forms an acknowledgment of the priority of the work done by the Cast Iron Research Association. The properties of the irons are dealt with in two Papers by Norbury and Morgan to the Iron and Steel Institute, the first in May, 1930, and the second in May, 1931, both of which, with discussions, have been reproduced in the Journal, and the history of the subject is dealt with and the above German Paper discussed in our April, 1931, Bulletin.—Yours, etc.,

J. G. Pearce,
Director.

The British Cast Iron Research Association,
24, St. Paul's Square,
Birmingham.
September 3, 1931.

[We were well aware that the abstract confirmed in a general way the results obtained by the B.C.I.R.A. staff, and our object in presenting it to the foundry public was to enhance, and not to detract from, this excellent piece of British research work.—Editor.]

Machining Allowances for Brass Castings.

To the Editor of The Foundry Trade Journal.

Sir,—Quite recently I had to produce some brass castings by hand moulding with an allowance of $\frac{3}{64}$ in. for machining; the results were not too satisfactory, as the castings would not machine clean. The castings in question are brass boiler plugs, which have to be screwed 11 threads per inch with 1 in 8 taper.

I would be very pleased if some of your readers would kindly say what machining allowances are generally made in Britain for brass castings, machine and hand moulded in green sand and dry sand.—Yours, etc.,

"Isolated Colonial."

The British Cast Iron Research Association.

The July Bulletin of the British Cast Iron Research Association announces that the following firms have recently been elected members: Gilbert Gilkes & Gordon, Limited, Kendal; Gjers, Mills & Company, Limited, Middlesbrough; James Howden & Company, Limited, Glasgow; Walter Macfarlane & Company, Glasgow; The Robert Mitchell Company, Limited, St. Laurent, Quebec, Canada; Morris Motors, Limited, Coventry; Shanks & Company, Limited, Barrhead, and W. Woodcock, Sons & Company, Limited, St. Helens. Two firms have also joined as trade members: The Scottish Enamelling Company, Limited, Larbert, and the United Glass Bottle Manufacturers, Limited, London.

Import Trade of India.—The Department of Overseas Trade (35, Old Queen Street, Westminster, S.W.1) has published a "Survey of the Import Trade of India" in the first three months of the current fiscal year (April to June, 1931); prepared by the British Trade Commission in Calcutta. Ref. No. C 3,645.

Random Shots.

Society Gossip.

In the company of pretty little Miss Gusseisen, I dined on Tuesday evening at London's newest night club, *Au Mouleur qui Jure*. The interior decorations are executed mainly and admirably in bronze, aluminium and wrought iron, and Monsieur Q. Pola's realistic mural paintings depicting foundry scenes present an illusion of local colour which, except that in no wise does the dance floor resemble the moulding floor of a foundry, approaches completion. Both the cocktail bar and the cloakroom, I noticed, are camouflaged as cupola charging doors.

* * *

Georges, the head waiter, who in the past was a fixture at the departed and lamented Engineers' Club, informed me that in the cuisines such equipment as ladles, jelly moulds and conveyors abound; and assured me that the ovens bake, but neither dry nor anneal.

* * *

I happened to mention to Miss Gusseisen the fact that Fords at Cork are soon to commence the manufacture of rain-water goods. "Really," she exclaimed, "I thought that they specialised in tractors and jokes, and not in mackintoshes!"

* * *

The cabaret had captured a truly Montmartre verve. Edith Witwell, one of M. Coquille's Young Ladies, sang her latest success, "She was only a foundryman's daughter, but she wouldn't attend to the chores." Later in the evening, the Four Men recited in their inimitable mock-heroic strain a perfect chaplet of humorous and slightly-censored verses, whilst Ivor Wadkin executed bewildering terpsichorean patterns at dizzy speed.

* * *

("Oiled to the core," deprecated Miss Gusseisen as a mutual acquaintance sagged from table and nearly collapsed.)

* * *

Mr. O. H. Bessemer, the well-known steel magnate, may have a reputation for couching basic truth in acid phrase, but never is his temper refractory. It was pleasurable once again to meet him after his so-long absence on the Continent. We encountered along Victoria Street, opposite the site on which the new six-storey headquarters of the Foundry Technicians' Society is being constructed.

* * *

Fixed upon the scaffolding was a large enamelled sign stating that British steel exclusively was being incorporated in the structure. "British steel," I approved, nodding in the direction of the girders being manœuvred into position. "That must be costing a pretty penny!" "Yes, it must," Mr. Bessemer agreed; "but not so much as the steelmakers would like it to cost!"

* * *

He brushed aside the topic as if it were an unpleasant one. "Some months ago," he said, "I was approached by a B.B.C. outside-broadcast official for advice on the matter of relaying from a steel plant a commentary on the process of manufacturing steel. I had to tell him that the idea, whilst being an excellent one, had one serious drawback from the point of view of broadcasting. You can't make steel without swearing." Mr. Bessemer explained that if a furnace manager were to sing out merely "Shove that rod in!" probably the men would stop to goggle at him; but if he sang out "Shove that —— rod in!" then the rod would be shoved in—and how! The presence of a microphone would introduce one of two risks: the spoiling of a bath of steel worth anything from £150 or the offending of the ears of some thousands of gentle listeners. So that the B.B.C. abandoned the project.

Marksman.

A Comparison of Natural-Bonded and Synthetic Moulding Sands for the Steel Foundry.*

By H. J. Cole.

In this plant the author has had occasion to check up the working properties of synthetic and natural bonded moulding sands for steel castings, and in this Paper the data secured from this work will be presented. The purpose is not to advocate the use of one type of sand, but rather to present the facts just as they were experienced by the author, both in the laboratory and in the shop. The data presented deal with dry-sand facings, containing all new sand and used only on large and high-grade castings. The strong sand used in the natural-bonded sand, and the sharp sand used in both the natural and synthetic mixtures are both from South Jersey. Fineness-test data for these sands are given in Table I.

TABLE I.—*Fineness-Test Data for Strong Sand and Sharp Sand from South Jersey.*

Strong sand.		Sharp sand.	
Retained on mesh No.	Per cent. retained.	Retained on mesh No.	Per cent. retained.
6	none	6	none
12	0.2	12	none
20	0.4	20	1.3
30	0.6	30	6.3
40	1.9	40	25.3
50	7.3	50	36.4
70	17.7	70	21.5
100	27.1	100	6.7
140	14.5	140	1.8
200	4.4	200	0.1
270	3.1	270	0.1
Silt	6.2	Silt	0.1
Clay substance	16.6	Clay substance	0.2
A.F.A. fineness	92	A. F. A. fineness	42
Grain class	4	Grain class	6
Clay class	F	Clay class	A

In the natural-bonded sand, the strong and sharp sands were varied in order to arrive at the best mixture. The variations used are listed in Table II. The 5 parts strong sand and 2 parts sharp sand mixture, as shown in Table II, is the

TABLE II.—*Variations Tried in Mixtures of Strong and Sharp Sands to Arrive at Best Mixture.*

Parts strong sand	7	6	5	4	3	2	1
Parts sharp sand	0	1	2	3	4	5	6
Moisture, per cent.	7.5	7.5	7.5	7.5	7.5	7.5	7.5
Green compression, lb. per sq. in.	9.0	8.7	8.1	6.0	4.2	3.0	1.0
Dry compression, lb. per sq. in.	120	111	80	52	41	20	8
Green permeability	40	43	54	86	110	140	163

mixture that will be dealt with in this Paper, because this comes within the author's established limits for strength and permeability. The synthetic sand was made by adding 12 per cent. fireclay to the sharp sand. The analysis of the fireclay used is given in Table III.

TABLE III.—*Analysis of Fireclay.*

Ignition loss, per cent.	12.44
SiO_2, per cent.	57.32
Al_2O_3, per cent.	27.36
FeO, per cent.	1.82
TiO_2, per cent.	1.44
CaO, per cent.	0.19
MgO, per cent.	0.30
Alkalies, per cent.	0.20
Fusion point	Seger cone 30-31
Mesh	30

* Abstract from a Paper read before the American Foundrymen's Association.

Refractoriness of Clays.

Clay was washed from a sample of strong sand, and tested for refractoriness in comparison with the fireclay, with the following results:

	Standard cone No.	Fusion point deg. C.
Clay (washed from strong sand)	10	1330
Fireclay (used in synthetic sand)	30	1730

The clay washed from the strong sand had the following analysis: 40 per cent. silicon, 15 per cent. iron oxide, and 20 per cent. alumina.

Although the clay in the strong sand has a much lower fusion point than the fireclay, it has been proved that there is less trouble from sand fusion when using the natural-bonded sand. The excess sand fusion with the synthetic sand is caused by metal penetration due to the high permeability of the sand. Many foundries using a synthetic sand bring down the permeability by the addition of silica flour. This method is not entirely satisfactory, as not only is the drying of the mould retarded but the backing sand is eventually filled with fines, making reclaiming more difficult. The closing-up of the sand should be at the surface only, and this is accomplished by two or three applications of silica face wash, having a specific gravity about 1.9.

Milling Time.

Samples of synthetic and natural-bonded sands were taken from the foundry mill at the end of one min., five min. and so on up to 25 min., and tested for green-compression strength. The results were as follow:—

Minutes	1	5	10	15	20	25
Natural sand, lb. per sq. in.	3·6	4·5	6·8	7·5	8·5	8·5
Synthetic sand, lb. per sq. in.	3.0	4.0	5.1	5.1	5.2	5.4

It is to be noted that the synthetic sand reaches its maximum green strength at the end of 10 min., whereas the natural-bonded sand reaches its maximum green strength at the end of 20 min. The increase in green strength of the synthetic sand at the end of 20 min. is due to the decrease in moisture rather than to longer milling.

Cores 2 in. by 2 in. square made from natural and synthetic sands were rammed various blows with a 14-lb. weight and tested for green-compression strength and permeability. Compression-strength data from this test are shown in Table IV. It is to be noted that the strength of the natural-bonded sand increases and the permeability decreases, more rapidly than with the synthetic sand, with the amount of ramming done.

TABLE IV.—*Compression-Strength Tests on Natural-Bonded and Synthetic Moulding Sands.*

	Green compression.		Dry compression.			
Foot-lb. on core.	Lb. per sq. in. Natural	synthetic.	Lb. per sq. in. Natural	synthetic.	Permeability Natural	synthetic.
1		3.0	46	43	93	187
2	5.8	4.3	58	47	73	175
3	7.6	5.0	83	52	52	153
4	9.0	5.1	120	53	40	150

One series of cores was made from natural-bonded sand, and one series was made from synthetic sand. After baking cores for 2 hrs. at 180 deg. C. and cooling in a desiccator, each core was placed in a small pan containing 25 c.c. of water which had been made slightly alkaline by the addition of a few drops of ammonia. A strip of litmus paper was placed on each core, and the time elapsing from the moment when the core was placed in the pan to that when the litmus paper turned blue was recorded in seconds. The average time for the naturally-bonded sand core was 21 sec. whilst the synthetic sand was 31 sec.

Defective Castings Caused by Gas Pressure.

Of the many defects found in castings, perhaps the most troublesome is the blowhole, especially when the cavity does not show itself until perhaps 80 per cent. of the total cost has been expended. When molten steel is poured in a mould, large volumes of gases are formed, in the following ways:—(*a*) By the moisture in backing sand in a large mould working to the surface by capillary attraction and coming into contact with the molten metal, causing steam; (*b*) by expansion, due to the intense heat of the air in the pores of the sand or the mould itself; (*c*) by the hot metal coming into contact with the organic matter in the sand; and (*d*) if conditions are right, explosive mixtures will be formed by molten steel liberating hydrogen from water and combining with the air that is in the mould.

If these gases cannot escape through the sand forming the mould, then the mould surface, through rise in pressure, is either pushed away, causing a scab, or the gases are forced back into the metal, causing blowholes. There is more gas formed in a natural-bonded sand, due to its ability to take up moisture and to the great amount of organic matter present. Therefore, the backing sand used with a natural-bonded sand should be more open than the backing sand used with a synthetic sand.

Summary.

MATERIALS.

Natural-Bonded Sand.

The clay content of deliveries of strong sand will vary from 12 to 18 per cent. Clay in sand not refractory.

Synthetic Sand.

Sharp sand more uniform. Fireclay can be chosen from one of many firms for its refractory and bonding properties.

MILLING.

Natural-Bonded Sand.

Longer milling time needed to bring sand up to its maximum green strength. More rigid control needed, as sand in shed will vary from 2 to 6 per cent. moisture, and from 40 to 60 permeability.

Synthetic Sand.

Sharp sand free from clay contains little or no moisture; therefore, a definite amount of fireclay, when added, is better distributed throughout the sand. A definite amount of water can be added, and the sand milled for a given time. Better control, as sand is easily standardised.

WORKING.

Natural-Bonded Sand.

Moisture range from 5 to 9 per cent.; therefore, a wide permeability range. Sand tools better on wet side. Apt to ram too hard in spots, causing blowholes and scabs. Permeability of backing sand must be kept above 150. Sand does not dry out readily on standing. A thinner application of silica wash can be applied.

Synthetic Sand.

A moisture range from 4 to 6 per cent. Tools better on dry side. Impossible to ram sand too hard. More uniform ramming. Sand dries out more readily on standing. Permeability of backing sand must be kept above 100. Silica

(*Concluded on page* 161.)

The Manufacture and Properties of Malleable Iron Castings.

(*Concluded from page* 144.)

Properties of Malleable Iron.

The properties of malleable iron covered in this Symposium are listed in the following paragraphs. As a convenient summary, average values for chemical composition, physical constants and certain mechanical and electrical properties are given therein.

Most of the data herein reported have been furnished specifically for purposes of analysis and summary by the Symposium Committee. Many of the tests, especially those for tensile properties, have extended over a considerable period of time and it was not practicable for investigators to submit to the Committee individual results of hundreds, and sometimes thousands, of such tests. Therefore, in general, the only means of indicating the dispersion or spread of the distribution of values has been to report the maximum and minimum values, although it is appreciated that the range between maximum and minimum is an inadequate measure of such distribution.

Chemical Composition.

It will be clear from the description of the manufacture of malleable iron castings that the product consists of a mixture of iron, in the form of ferrite, and free carbon or graphite in the form of "temper" carbon. Combined carbon as cementite or pearlite should not be present in properly annealed malleable iron. It will also be evident that the elements silicon, manganese, phosphorus and sulphur are present. The percentages of these elements and of carbon may vary considerably in different types of iron, depending upon the properties desired, especially tensile strength. (In general, carbon and tensile strength vary inversely.) Also, carbon at the centre of a thick section may be nearly the initial total carbon, and very thin sections may be almost completely decarburised. Therefore, the following tabulation of average chemical composition is at best only approximate.

C	..	1.00 to 2.00 per cent.
Si	..	0.60 to 1.10 ,,
Mn	..	under 0.30 ,,
P	..	,, 0.20 ,,
S	..	0.06 to 0.15 ,,

(usually about 0.10 per cent.).

Inasmuch as there is no combined carbon in malleable iron, phosphorus may be present in the amount indicated without danger of cold shortness. Also, since malleable iron is not hot-worked, a sulphur content within the range indicated is not objectionable.

Physical Constants.

Specific Gravity.—The specific gravity of malleable iron varies with the carbon content

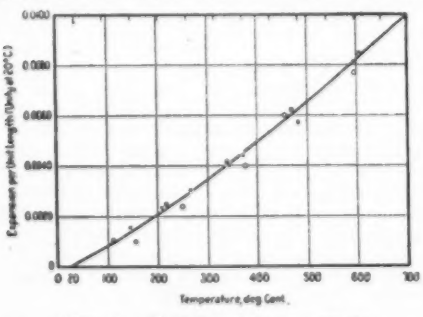

Fig. 1.—Thermal Expansion of Malleable Iron.

and is best expressed as ranging from 7.15 to 7.45 at 20 deg. C., referred to water as 1 at 4 deg. C.

Thermal Expansion.—Careful measurements of linear expansion of malleable iron when heated over varying temperature ranges, made by three investigators, have been plotted in Fig. 1, in which the ordinates are expansion per unit length, considering length at 20 deg. C. as unity. Coefficients of expansion for various temperature ranges may be determined from the curve plotted, and will increase slightly with higher temperatures. For temperatures up to approximately 400 deg. C. a value of coefficient of expansion per deg. C. sufficiently accurate for ordinary computations is 0.000012.

Specific Heat.—Direct calorimetric determinations of mean specific heat of malleable iron between room temperature (20 deg. C.) and various higher temperatures are reported as follow:—

Mean Specific Heat.

Temperature range, deg. C.	Calories per gram per deg. C.
20 – 100	0.122
20 – 200	0.125
20 – 300	0.128
20 – 400	0.133
20 – 500	0.139
20 – 600	0.146
20 – 700	0.159

Since malleable iron is a mechanical mixture of approximately pure iron and graphite, its specific heat should be calculable from the data for these substances. Such a calculation gives 0.1102 calories per gram per deg. C. at room temperature. This is approximately concordant with the direct observations, but a little lower.

Mechanical Properties.

Tensile Strength, Yield Point, Elongation.—Average values of tensile strength, yield point and elongation of malleable iron, determined from the results of upwards of twenty thousand tests reported by seventeen investigators, are as follow:—

Tensile strength	..	24 tons per sq. in.
Yield point	.. ..	14 ,, ,, ,,
Elongation in 2 in.	..	18 per cent.

Reduction of Area.—This constant is infrequently determined and values on the usual "as-cast" specimens are not especially useful. Machined specimens permitting accurate determinations are not usually prepared. Malleable iron stretches throughout the length of the specimen with little local "necking." On standard specimens ground cylindrical before annealing, values for reduction of area of 18 to 23 per cent. may be regarded as representative of material of standard quality.

Modulus of Elasticity in Tension.—The modulus of elasticity of malleable iron in tension is about 11,000 tons per sq. in. The determination of this modulus involves accurate measurement of load and elongation. Measurement of the latter is complicated by residual strains that may be present in the cast test-bars, and for reliable determinations carefully straightened specimens should be used.

Compressive Strength; Transverse Strength.—Because of its ductile character, malleable iron seldom or never actually fails under either compression or transverse loading. In compression the material flows indefinitely, and in cross-bending it deforms to an extent rendering the part useless in service before fracturing. Careful work on a limited number of specimens has confirmed the plausible supposition that the modulus of elasticity in compression is very near that in tension; for purposes of design from the deflection viewpoint a value of 11,000 tons per sq. in. for this constant may be used. In compression the material takes a permanent set of 1 per cent. at about 12 tons per sq. in.

For actual failure in cross-bending, an apparent maximum fibre stress of the order of magnitude of twice the tensile strength is required.

Shearing Strength.—In direct shear, malleable iron has an ultimate strength of about 48,000 lbs. per sq. in. (approximately nine-tenths of the tensile strength) and a yield point of about 23,000 lbs. per sq. in.

Torsional Strength.—Torsion tests of malleable iron are seldom made. From results reported by two investigators, the value of modulus of rupture in torsion may be taken as about 58,000 lbs. per sq. in. and the yield point as about 24,000 lbs. per sq. in.

Brinell Hardness.—The Brinell hardness of malleable iron is usually about 115 and values may range from about 100 to about 140. The Brinell hardness is in large measure a function of the free-carbon content. There exists a general relation that metal of high tensile strength is usually higher in Brinell hardness and *vice versa*. The correlation is, however, not sufficiently close to use Brinell tests in substitution for tension tests. An increase in tensile strength of 4 tons per sq. in. is accompanied by an increase in hardness of only about 15, while the maxima and minima of hardness values for a given tensile strength often depart by this much from the average.

Nor is Brinell hardness a useful indication of machinability unless the observed hardness falls very far above the range of values given above. The Brinell test will detect an unannealed or enormously under-annealed product, but will not differentiate between two materials of nearly similar and normal machinability. Nor will it detect pearlitic rims of sufficient magnitude to affect machinability greatly.

Impact Strength.—Charpy impact values for malleable iron are seldom determined, and an average value of 7.75 is the best that can be reported. One investigator reports Izod impact values on malleable iron, before galvanising and after galvanising, as 9.3 and 8.5 ft.-lbs., respectively.

The so-called "wedge test" is frequently made on malleable iron as a general indication of the ability of the product to withstand impact. The following is a brief description of this test:—

A wedge of the material 6 in. long by 1 in. wide, tapering in thickness from ½ in. at the butt to $\frac{1}{16}$ in. at the tip or thin end, is subjected to successive blows of a 21-lbs. tup falling from a height of 3½ ft., representing energy of 70 ft.-lbs. The thin end is first bent over for a length of about ½ in. by means of a hand hammer, starting a "curl." Then the wedge is firmly secured, in approximately a vertical position, at the butt end in a clamp which forms part of an anvil. The tup strikes the curl at the thin end of the wedge, and the clamp is so fitted that the wedge can be gradually tilted from a vertical position in order that the tup may always strike the highest point of the curl. The number of blows required to produce the first sign of fracture is recorded. Obviously the energy of each succeeding blow increases slightly, as the distance through which the tup falls increases by the amount of deformation of the wedge. While the test is distinctly an arbitrary one, it has the merit of being easily and cheaply made, and it seems to be a fairly reliable measure of the shock-resisting qualities of the metal, giving results consistent with the observations of practical experience. It is customary to end the test at 30 blows if no fracture has developed by that time.

Fatigue Endurance Limit.—Only one careful determination of fatigue endurance limit of malleable iron is known. This was made on iron of slightly above the minimum properties of A.S.T.M. Specifications A 47—30, using the rotating-beam (Farmer type) machine—producing alternate tension and compression in flexure—on a specimen 0.40 in. in diameter, the radius at the point of failure (minimum diameter) being about 3 in. An endurance limit between 25,000 and 26,000 lbs. per sq. in. was indicated, thus

agreeing with the frequently observed ratio of endurance limit to tensile strength of wrought ferrous metals of approximafely 0.5.

Effect of Temperature on Properties.—If malleable iron is heated above the lower critical point, about 760 deg. C., carbon redissolves and the character of the material changes. Hence the use of malleable iron at temperatures over about 650 to 705 deg. C. should be avoided.

Malleable iron retains its normal "room temperature" tensile strength at temperatures up to about 427 deg. C.; above that temperature the strength decreases rapidly, being at 650 deg. C., only one-fourth to one-fifth the tensile strength at room temperature. The elongation is also practically constant up to 427 or 482 deg. C., and rises sharply above the latter temperature.

A few tests on impact strength of malleable iron at temperatures from about −25 to +200 deg. C. have been reported by Schwartz.* These tests show impact resistance to be apparently unaffected by change in temperature from room temperature (20 deg. C.) to 200 deg. C., but to drop sharply below 20 deg. C. to Charpy values as low as 3 ft.-lbs. at −25 deg. C. compared to about 8 ft.-lbs. at 20 deg. C.

Malleable iron, unless heated above the critical temperature, is immune from growth at high temperatures by graphitisation, and practically so from growth by oxidation of silicon or migration of gases. In fact, there appears to be no growth of malleable castings at temperatures for which they are intended to be used. Similarly, within the critical temperature there is little tendency to oxidation at high temperatures.

Machinability.

The machinability of malleable castings cannot be dealt with quantitatively since there is no generally accepted test procedure or unit of measurement. It is generally known that as measured by tool life or cutting speed in commercial operations, malleable iron machines more readily than any other ferrous material. Although there are differences of opinion as to whether variations in tensile properties of malleable iron are accompanied by variations in machinability, it may be said that for practical purposes such variations are not sufficient to contradict the preceding statement for any normal grade of malleable iron. Obviously, metal which accidentally or purposely contains pearlite is not included in this generalisation.

Where the machine and tool set-up permits, it is standard practice to take roughing cuts of $\frac{1}{16}$ to $\frac{1}{4}$ in. with a feed of 0.02 to 0.03 in. at cutting speeds of 120 to 135 ft. per min., and finishing cuts of 0.01 to 0.02 in. with a feed of 0.010 to 0.015 in. at cutting speeds of 200 to 220 ft. per min. This contemplates the use of ordinary high-speed tools; much higher speeds are obtainable with some of the more modern cutting alloys.

Heat-Treatment.

This Symposium is solely concerned with a material substantially completely converted into ferrite and graphite in the so-called "nodular" form (temper carbon). If such material be heated above the lower critical point, say, 760 deg. C., obviously carbon will redissolve. On subsequent cooling at rates comparable to those of the original annealing process; this carbon will reprecipitate in the free state. Faster cooling, leaving insufficient time for the graphitising reaction, will leave the system in the metastable condition and produce in the metallic matrix structures similar to those of high-carbon steels of similar heat-treatment: martensite, pseudo-martensite, troostite, sorbite, laminated or granular pearlite or spheroidised cementite. Further modifications are possible in that resolution and diffusion of carbon require time, and by control of this element free ferrite can be retained along with these structures.

* "Proceedings," American Society Testing Materials, Vol. 24, Part II, page 164 (1924).

The physical properties of material so heat-treated will be an integration of the effect of free carbon in interrupting the matrix, the amount of combined carbon determined by the time and temperature of reheating, and the metallographic condition of this carbon fixed by subsequent cooling or drawing treatments.

The properties of the resultant metal will evidently be capable of considerable variation. Since the changes are always essentially the substitution of steel for pure iron accompanied by a decrease in graphitic carbon, the resultant change in properties will be toward higher strengths and lowered ductility. These possible changes furnish a useful means of producing special properties for special purposes from malleable castings.

Other products of similar characteristics are produced by suitable modification of the original annealing cycle of a character to retain combined carbon in some desired metallographic form. A treatment of these metals is beyond the scope of the Symposium.

In common with many other ferrous materials, malleable irons when rather rapidly cooled from the "blue heat" range, say, 450 deg. C., as in galvanising, may suffer from intergranular brittleness. If heated to 675 deg. C. and quenched, the tendency to become so embrittled is for practical purposes completely destroyed. The theory of this process is not completely understood. It is known, however, that the tendency to this embrittlement is related to chemical composition to such a degree that the fault can be avoided by chemical means.

Catalogues Received.

Metal Hardening.—A leaflet received from the Patent Gear & Metal Hardening Company, Limited, 69, Horseferry Road, London, S.W.1, contains a number of testimonials to the efficiency of the Shorter processes from satisfied users.

Case-Hardening Compound.—G.W.B. Electric Furnaces, Limited, Elecfurn Works, North Road, Holloway, London, N.7, have prepared a four-page leaflet which details the merits of "Eternite," shows graphically the steady progress made by this compound, and offers free samples to prospective users.

Sand Preparation.—We have received from The Universal System of Machine Moulding & Machinery Company, Limited, 13-15, Wilson Street, London, E.C.2, an eight-page leaflet which describes and illustrates two models (BMC 180 and BMC 240) of a sand mill. The issuing house designates them sand-rubbing machines, and their technical staff attaches great importance to this particular phrase. Because of this, the leaflet makes very interesting reading. We are sure that recipients will appreciate such matters as the inclusion of specifications and the telegraphic code. A feature of this mill is its continuous action, and suitability for inclusion in an automatic continuous-casting plant.

Colloidal Graphite.—We have received from E. G. Acheson, Limited, 40, Wood Street, Westminster, London, S.W.1, a technical bulletin, complete with thin cardboard cover ready for filing, covering the subject of lubrication, in so far as colloidal-graphited oils are concerned. An abundance of reliable technical data is included, such as some N.P.L. tests, which show clearly the advantage of resorting to this material, by reducing friction.

A short bibliography of the subject has been included as an appendix, and this could with benefit be rearranged by first listing the text-books and then setting out the others under, first the language and then the name of the author—the title of the Paper and where the matter is to be found. However, this is a small point, and, undoubtedly, this publication is just the type which every founder should obtain and carefully preserve for reference.

A Comparison of Natural-Bonded and Synthetic Moulding Sands for the Steel Foundry.

(*Concluded from page* 159.)

mould wash should be thicker. Often two or three applications needed to prevent excess metal penetration. If moisture is on dry side, dry strength will be low. Sand more friable.

Drying.

Natural-Bonded Sand.

Contains more moisture. Is less permeable. Holds on to its moisture more tenaciously; therefore, takes longer time to dry. Less cracking of mould surface.

Synthetic Sand.

Contains less moisture. Sand more open; therefore, it takes shorter time for moulds to dry. Over 12 per cent. clay causes cracks on mould surface.

Closing.

Natural-Bonded Sand.

If large mould that is not dried in centre is left standing several days, moisture will work more quickly toward surface. Moulds will take up dampness from foundry more quickly. Higher dry strength; moulds not easily damaged on standing.

Synthetic Sand.

Capillary attraction is less; therefore, sand will not readily take up moisture from backing sand. Lower dry strength; moulds more easily damaged on standing.

Pouring.

Natural-Bonded Sand.

Moulds should be filled quickly to prevent "cooking" of less refractory clay by radiant heat. More gases generated, as the nature of sand is ferruginous, and also due to higher moisture remaining in mould after drying.

Synthetic Sand.

Moulds can be poured more slowly because of more refractory clay. Less gas generated, because of lower moisture remaining in sand after drying and the absence of hydrated ferric oxide.

Cleaning.

Natural-Bonded Sand.

Sand peels better from castings. Better surface is obtained. Unsound castings are usually from blowholes, pinholes and scabs. Cleaning cost is lower. Surface is of a bluish colour.

Synthetic Sand.

Sand does not peel well from casting. Surface grey in colour, rough, and often pitted. Unsound castings are usually from fusion due to metal penetration. Cleaning cost is higher.

Reclaiming.

Natural-Bonded Sand.

Less sand can be reclaimed, due to large quantity of silt and burned clay present.

Synthetic Sand.

More sand can be reclaimed; many foundries are reclaiming as high as 80 per cent.

Record Output at Jamshedpur.—The Bessemer converters of the duplex plant of the Tata Iron & Steel Company, at Jamshedpur, India have just established what is claimed to be the world's record output for an 8-hour shift during which 71 blows were obtained working 3 converters of which only two were in operation at any one time. The total metal blown was 1,348 tons, or an average of 19 tons per blow. The American record, held by the Gary works, is believed to be 57 blows per shift. Another record—it is claimed—has been established by the merchant mill department which, on July 28, reached the record output of 677 tons in three 8-hour shifts. The department thus beat their own previous record of 669 tons produced in June last year. It is understood the world's best record production on a similar type of mill is about 655 tons a day.

XUM

Programme of the Pan-European Foundry Congress.

September 12.—9 a.m., Opening meeting of the Congress at the Offices of the Milan Fair; Visit to the Exhibition. 2.30 p.m., Visit in parties to local factories.

September 13.—10 a.m., Official opening of the Exhibition. 1 p.m., Official Banquet offered by the Federazione Nazionale Fascista dell'Industria Meccanica e Metallurgica. 2.30 p.m., Free for sightseeing. 4 p.m., Visit to the Race Course at San Siro (Race for the St. Leger Stakes) at the invitation of the S.I.R.E. (please register beforehand).

September 14.—9 a.m., Meeting of the Congress at the Milan Fair. Presentation and discussion of Papers in the following sections: Cast Iron and Steel; Sand and Loam, and Non-ferrous Metals. 2.30 p.m., Visit in parties to local factories or excursions to Brescia, or Legnano or Pavia (please register beforehand). *For the Ladies:* Whole-day excursion to the Lake Como, visiting Villa Carlotta; Lunch at Tremezzo.

September 15.—9 a.m., Meeting of the Congress. Presentation and discussion of Papers in the following sections: Cast Iron and Steel; Non-ferrous Metals. Discussion on Papers presented to the Convegno dei Tecnici Metallurgici Italiani. 2 p.m., Meeting of the Congress. Presentation and discussion of Papers in the General section. Discussion on Papers presented to the Convegno dei Tecnici Metallurgici Italiani. *For the Ladies:* Excursion by motor-car to the Certosa of Pavia. 6 p.m., Reception by the Podestà (Mayor) of Milan at Palazzo Marino (Town Hall). 8.30 p.m., Banquet.

September 16.—9 a.m., Meeting of the Congress. Presentation and discussion of Papers in the General section. 2.55 p.m., Leave for Chivasso-Aosta by train.

September 17.—Morning: Visit to the Steelworks of the S.A. Nazionale Cogne in Aosta. Afternoon: Excursion to Pre' St. Didier and thence to Courmayeur or to the Piccolo San Bernardo.

September 18.—*Party* "*A.*"—Morning: Excursion to Cogne for Visiting the Mines of Liconi and Colonne. Afternoon: Visit to the Plant and Galleries of the Drinc; arrive Turin for dinner. *Party* "*B.*"—Morning: Visit to the Works of the Fonderie Olivetti at Ivrea, arriving Turin at noon. Afternoon: Visit to the Fiat Works, Acciaierie, Grandi Motori e Fonderie Cilindri.

September 19.—Morning: Visit to the Fiat Lingotto and to the Unica Factory. Afternoon: Free for sightseeing. Reception at the Palazzo Madama (Royal Palace).

September 20.—Morning: Leave for Genoa. Afternoon: Visit to the Port; Dinner on board the Transatlantic liner "Roma."

September 21.—*Party* "*A.*"—Whole-day Excursion by motor-car to visit the Tubi Foundry at Cogoleto, the Servettaz-Basevi Works at Savona, the Tecnomasio Italiano Works at Vado-Ligure. *Party* "*B.*"—Morning: Visit the Ansaldo Works. Afternoon: Visit to the City. Both parties leave by night train for Rome.

September 22.—Morning: Arrive in Rome. Afternoon: Visit to the City.

September 23.—Morning: Leave for motor-car excursion through Umbria; visit the Centrali Idroelettriche of Terni; Lunch at Spoleto. Afternoon: Visit Assisi and arrive Perugia.

September 24.—Morning: Visit Perugia and leave for Todi and Orvieto; Luncheon. Afternoon: Continue the trip through Viterbo and arrive Rome.

September 25.—Morning and Afternoon: Free for sightseeing.

September 26 *and* 27.—Closing meeting of the Congress in the Campidoglio, attended by H.E. the Prime Minister; Reception by His Excellency the Governor of Rome; Reception by the Confederazione Generale Fascista dell'Industria Italiana.

September 28.—Leave Rome.

Papers to be Presented.

Cast Iron and Steel.

(1) "Oxidation as a Factor in the Question of the Inherent Properties," by a Committee of the Belgian Foundry Technical Association.

(2) "High-Silicon Pig-Iron for Malleable-Iron Manufacture," by L. Boegehold and C. L. Joseph (American Exchange Paper).

(3) "Growth in Grey Iron at Elevated Temperatures," by G. Galbiani.

(4) "Quenched and Super-Quenched Cast Iron—Recent research and applications," by R. Chany.

(5) "A Note on the Melting of Synthetic Cylinder-Quality Grey Iron in the Electric Furnace," by L. Del Grosso.

(6) "Note on the Manufacture of Synthetic Iron in the Electric Furnace," by R. Dupuis and C. Braghieri.

(7) "A Contribution to the Study of 'Life' in Liquid Steel," by V. Gabino.

(8) "Manganese Steel—Its Structure and Properties," by G. Guzzoni.

(9) "On Certain Abnormalities in the Hardness of Cast Iron," by A. Le Thomas.

(10) "Barrels of High-Speed and Stainless Steel for Modern Machine Guns—Practical Experiments on their Relative Efficiency," by A. Mele and Bertelli.

(11) "Mechanical Properties of Malleable on Various Sized Test-Bars," by Dr. A. L. Norbury (British Exchange Paper).

(12) "A Contribution to the Study of Cupola Melting," by Prof. Pisek (Czeck Exchange Paper).

(13) "Notes on the S.E.S.C.I. Rotary Furnace" (Anon.).

(14) "Influence of Small Additions of Aluminium to Grey-Iron Castings," by Prof. G. Sirovich.

(15) "A Contribution to the Study of Inherent Properties in Cast Iron," by Prof. Thyssen and A. Buffet.

(16) "Manufacture of Ingot Moulds—Composition, Life and Causes of Defects," by V. Travaglini.

(17) "Short-Annealing Cycle Malleable Iron," by V. Wollenigh.

Non-Ferrous Castings.

(18) "Light Alloys in Modern Architecture," by Anon.

(19) "Special Cupro-Nickels," by M. Ballay (French Exchange Paper).

(20) "Soundness and Strength of Aluminium Castings in Relationship to the Casting Temperature, the Gas-Solubility and to the Rate of Cooling," by M. Barbero.

(21) "Considerations of the Physical Characteristics of a 87:8:5 Bronze in Relationship to Grain Growth due to Melting, Casting Temperature and Section Thickness of Casting," by M. Blasic.

(22) "A Note of the Rapid Determination of Phosphorus in Bronze," by M. Blasic and R. Pepino.

(22a) "The Volumetric Determination of Tin in White Metals," by D. Lombardo.

(23) "Cast light-alloys in Aero-Engine Construction," by C. Panseri.

(24) "The Analysis of Nickel-Chrome Alloys," by V. Pastelli.

(25) "Notes on the Casting of Sheet-Bars in Aluminium," by M. Pontremoli.

Sands and Refractories.

(26) "A Study of All Questions Appertaining to the Testing of Moulding Materials and their Practical Application in the Foundry," by P. Aulich (German Exchange Paper).

(27) "The Testing of Grain Size in Foundry Sands and Loams," by G. Sulliotti and E. Capello.

(28) "A Contribution to the Study of Permeability of Foundry Sands," by L. H. Viez.

(29) "The Application of Fused Silica for Moulding and Core Making," by Anon.

General.

(30) "On the Distribution of the Electric Field in the Arcs of Electric Steel Melting Furnaces," by C. Agostinelli.

(31) "On the Present State of the Metallurgical Relationships between Rumania and the East," by J. Arapu.

(32) "Researches into the Limit of Wear in Grey Irons of Various Compositions," by E. Balma.

(33) "The Organisation of the Iron and Brass Foundries of the Chemin de Fer du Nord," by M. Castelain.

(34) "Proposals for a Systematic Classification of Foundry Defects," by K. Gierdziejewski.

(35) "A Method for Determination of the Machinability of Cast Iron," by M. Mei.

(36) "Foundry Organisation and Cost Control," by R. Monti.

(37) "Deep Case-Hardening with Liquid Media," by I. Musatti and L. Donatelli.

(38) "Foundry Defects from the Metallographic and Manufacturing Aspects," by A. Portevin.

(39) "Standardisation of Raw and Semi-finished Materials used in Automobile Iron Foundries," by V. Prever.

(40) "Improvement of Product and Diminution of Manufacturing Costs in Foundry Practice," by E. V. Ronceray.

(41) "Experiments Made for Elucidating the Question of the Risk of Breakages in Castings," by M. Ros and A. Eichinger.

(42) "Water-cooled Ingot Moulds; Their Construction, Wear and Life," by K. Scherzer.

Foundry Classes.

The Sir John Cass Technical Institute, Jewry Street, Aldgate, London, E.C.3, through its Principal, Mr. Geo. Patchin, A.R.S.M., has sent us a booklet illustrating and describing the work done by the metallurgical department. Included in this faculty is a special section devoted to foundry work. The equipment includes core oven, moulding machine, gas-fired crucible furnace capable of melting 60 lbs. of steel, gas and electrically-heated heat-treatment and case-hardening furnaces, and a complete set of B.C.I.R.A. sand-testing apparatus. Mr. A. F. Gibbs, a past-chairman of the London Section of the Institute of British Foundrymen, is on the staff as a lecturer in foundry practice. We are cognisant of the work done in the Sir John Cass Technical Institute for the foundry industry, and consider that it is worthy of much greater support than it receives at present from the metropolitan foundry industry. We would like this pamphlet to be studied by every foundry owner and manager in this area with especial care as it assumes much greater importance than ever before as the Institute of British Foundrymen in co-operation with the City and Guilds of London Institute and the Institute of Mechanical Engineers has made possible the granting of proficiency certificates of two kinds of a nationally-recognised character. The tuition described is eminently suitable for the attainment of these certificates.

Recent Extensions to the Foundry of John Harper & Company, Limited, Willenhall.

In our issue of October 11, 1928, we published an illustrated description of the New Foundry of John Harper & Company, Limited, Willenhall. The author, Mr. Percy Fox Allen, then said: "In 1927 it was decided to build an entirely new foundry on this site (Clarke's Lane, Willenhall) with the idea of embodying the latest foundry practice in operation in Great Britain, America and on the Continent, at the same time having in mind that the maintenance of the high quality of the products was of paramount importance. For the time being the old plant is being worked to full capacity, but it is hoped by successive enlargements of the new works gradually to transfer the whole of the operations to the new site." The notes which follow show just how this progressive policy has successfully developed. Primarily the foundry building itself has been increased from an area of 400 ft. × 90 to 600 ft. × 180 ft., or 300 per cent. The striving after quality has undoubtedly materially effected the general method of working, and mechanisation has been undertaken only when there is a reasonable assurance that the skin and soundness of the resultant castings would be improved. For instance, a continuous foundry, with mould conveyors and the like, was studied but not adopted, as it was felt that the variety of the product demanded more individual attention than could be accorded under completely mechanised conditions. Moreover, by casting only in the afternoon, it was found possible to keep more of the staff on productive labour, and permitted the moulders to cast up their own work, a factor of the utmost importance when a great diversity of work is undertaken.

The annual output of the foundry is now 7,500 tons of castings, approximately one-quarter of which is consumed in other departments of the works for the production of general hardware and engineering goods of the smaller type.

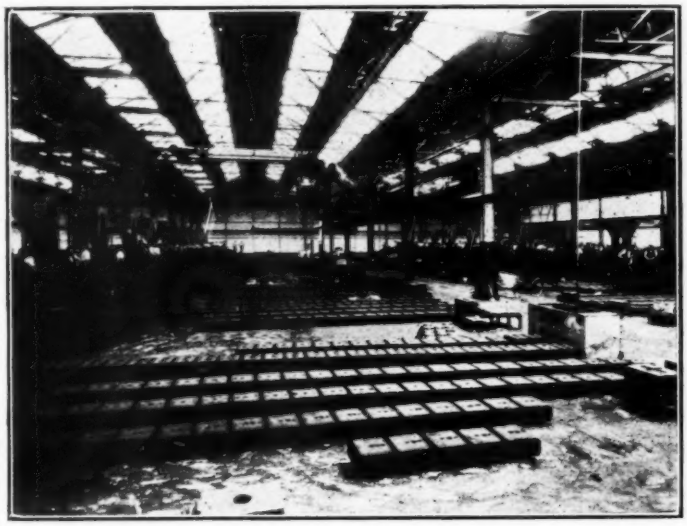

Fig. 1.—The Iron Foundry of Messrs. John Harper & Company, Limited, Willenhall. There are 90 Hydraulic Squeeze Machines in this Section.

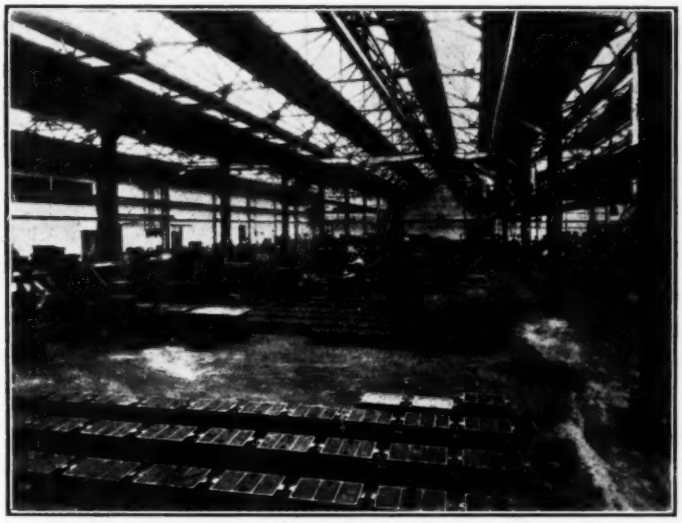

Fig. 2.—This Bay uses Boxes and Pneumatic Moulding Machines.

Melting Plant.

The general lay-out of the melting plant was fully described in the article previously referred to, but since that time there has been added a 12-ton-an-hour British Cast Iron Research Association's balance blast cupola, situated mid-way in the longer wall of the foundry. A detailed description* of this plant was recently given by Mr. J. G. Pearce. The metal is caught in 8-cwt. Pneulec ladles carried on Morris runways to the moulding floors, where for the lighter castings it is transferred to 80-lb. hand shanks. As more than 50 per cent. of the moulders are employed on snap-flask work, this can be considered as representative practice. Immediately in front of the cupolas is the ladle lining and drying department, and a well-arranged oil-fired furnace permits of the regular supply of properly prepared ladles and shanks. All over-metal is teemed into chill moulds of the type shown just near the water tank in Fig. 1. This material, together with any scrap castings, runners and the like, is loaded into drop-bottom trucks and carried by a 1-ton telpher crane direct to the cupola. No "bought" scrap is ever used in this concern, in order that a more effective compositional control can be instituted.

Sand Preparation and Handling.

New sand is brought to a centrally-disposed preparing plant by lorry and filled into adjoining bins. The old sand is brought to the sand-preparing plant by one of two Heywood telphers mentioned previously in connection with the shop scrap handling, and utilises a runway suspended above the gangways. Distribution of prepared sand to the hoppers situated above each snap-flask moulding machine is similarly effected, through the means of a second runway.

The sand-preparing plant has been installed by August Muffle Furnaces, and is unlike any other we have seen, in as much as final delivery is made into a line of six hoppers, in order to provide a like number of different varieties of facing sand. This factor shows just one more difficulty in the provision of continuous delivery of facing sand by conveyor. The sand is first freed from extraneous matter—hard core, paper and the like—by a revolving riddle. It is then passed over a magnetic separator drum to rid it of particles of iron. It then is elevated and fed into one of two 6-ft. pan Simpson mixers, and, after disintegration, fills any one of the storage bins. The backing sand is dressed on site after the cast.

Moulding Plant.

Almost one-half of the foundry is served by a battery of 90 hydraulic squeeze moulding machines, manufactured by Messrs. Henry Berry, of Leeds, to Harper's design. Of robust construction they work at 700 lbs. pressure, are provided with stainless steel cylinders, and have all the valve connections readily accessible above ground. Using snap-flasks, they are capable of handling extremely heavy demands for repetition orders made from either plates or oddsides. In this bay there have been installed, and at the time of our visit patterns were being made for, a pair of Bonvillain and Ronceray down-sand frame machines. These are to cater for the gas and electric cooker trades.

In the other half of the foundry, adjacent to the fettling shop, a number of pneumatically-operated machines of the Britannia and Osborn turnover machines are installed, the latter being mainly engaged on the production of stators and similar work. The type of work carried out in this section, being somewhat heavy, demands the use of a wide range of moulding boxes, and provision has been made for their storage by the erection of a special bay 400 ft. long. It is situated adjacent to the moulding floor and separated from it by expanded metal framework. The floor being constructed of a specially hard-wearing concrete, the use of petrol trucks is rendered profitable, and several of Lister's make are used for the handling of the moulding boxes and also for transferring the castings to the fettling shop.

Core-Making.

Along the outside wall is a raised platform, which carries the sand-drying and mixing machinery. As it has been found imperative to use several varieties of core sand, three small paddle mixers are in service, whilst their output can be supplemented by supplies brought in on the Morris runway from the central sand plant. The mixed sand is distributed to the core benches by tilting buckets carried on a pendulum conveyor. Each bucket carries a distinctive coloured tab, so that each core-maker can readily recognise her type of sand and replenish before her visible supplies have disappeared. Black sand is used for certain types of cores, which are to be covered with such a small, rapidly cooling, section of metal, that insufficient heat would be generated to

* Foundry Trade Journal. Page 437. Vol. 44.

burn out the oil, which is an essential function of oil-sand cores. The cores are dried in a battery of six Pneulec oil-fired, temperature-controlled stoves. For ordinary small cores a temperature of 225 deg. C. is used, but obviously weight and volume cause variations from standard to be adopted.

Patternmaking and Storage.

At the side of the core shop the pattern shop and pattern stores are situated. The shop is specially equipped for the production of metal patterns. Brass patterns are favoured, as unlike many other types their surface improves with age. The system is so arranged that all patterns, whether entering or leaving the pattern shop, pass through the stores for registration and inspection. The stores has a storage area of 50,000 sq. ft., carried on three floors, with interconnection by both stairs and lift. The system for identification is thus made by floor, gangway number and bin number. No wholesale transference has been made from the old foundry, and each pattern is being taken into stock as orders are forthcoming. This should make, in the course of a few years, for a thorough weeding out of obsolete patterns.

Fettling and Finishing.

We would specially call attention to the layout of the finishing departments, as we are convinced that the system adopted by this company is a distinct advance on any we have so far encountered. It is a fact that the sand blasting, inspection, chipping and grinding can involve a serious amount of handling at a corresponding cost for non-productive labour.

Primarily, the castings are transferred from the moulding floors by truck and loaded on to one of a bank of roller conveyors, as shown in Fig. 3. The smaller castings are carried in trays, whilst those of larger dimensions are sent down loose. It is predetermined whether the castings shall pass through a sand-blast barrel, a rotary table or a cabinet, and the corresponding set of conveyors are used. The three sand-blast units are all of the Fearnley-Allen-Gutmann type. In this connection we would draw attention to the fact that the sand-blast chamber shown in the middle background is provided with a circular bench, which permits of loading and discharging one-half whilst the other is under blast. The sand-blast plant is supplemented by a small battery of ordinary tumbling barrels. The freedom of the shop from dust is an excellent testimonial to the efficiency of the dust-exhausting arrangements.

Heat-Treatment.

Near the sand-blast barrel there is an oil-fired heat-treatment furnace, designed by the Incandescent Heat Company. It was described in the article previously referred to. Experience has shown that by controlling this furnace at 850 deg. C. a Brinell hardness of less than 100 can be obtained.

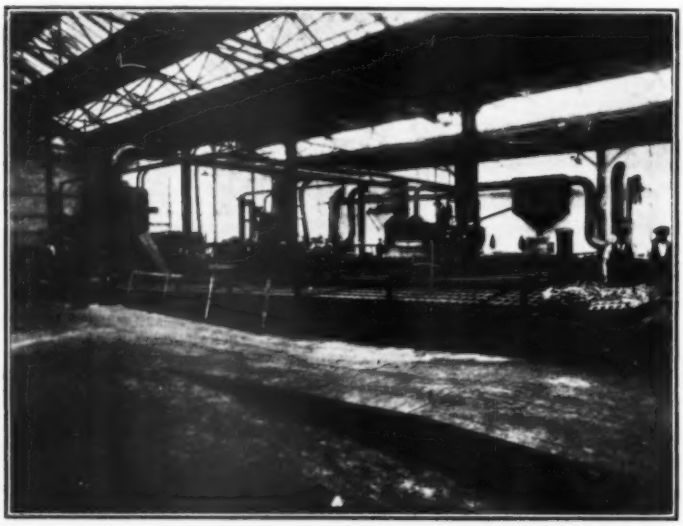

Fig. 3.—The Sand-Blast Machines are fed by a Bank of Roller Conveyors.

Fig. 4.—All Cleaning and Inspection is carried out on Roller Conveyors.

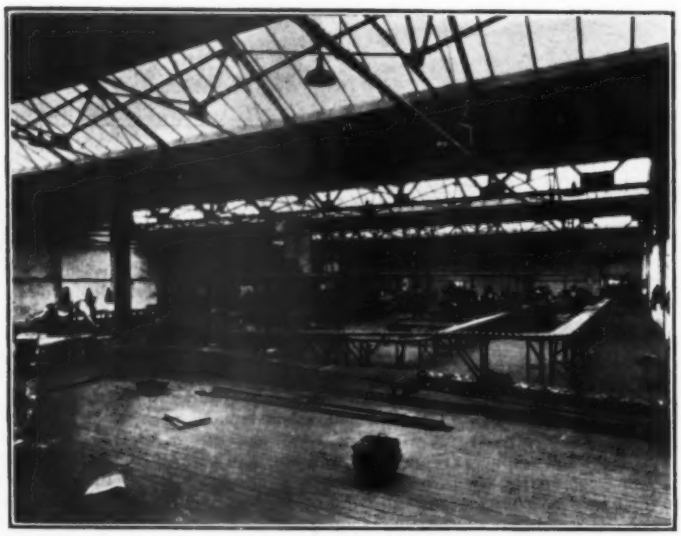

Fig. 5.—From Casting to Despatch, Work is kept Waist-high.

Fig. 6.—A Turntable in the Despatch Department allows for the ordered Separation of Castings for either Delivery or Storage.

Fettling and Grinding.

Throughout the whole of the finishing operations an effort has been made to keep all the work waist-high. Thus, from the sand-blasting machines, transference is made to the finishing shop on a further series of Morris conveyors. These are hinged shortly after their entrance into the fettling shop to allow skips containing scrap to be sent back through the sand-blast shop and foundry to the cupola. These openings are near to the inspection section, where the weight of good castings is ascertained and

(*Concluded on page* 166.)

The Moore Hot-Blast Cupola.*

By J. T. MacKenzie.†

The principles of the application of hot blast to the cupola have been so well stated by Vial[1] that it is not thought worth while to discuss these principles again. The purpose of the present Paper is to describe the installation at the plant of the American Cast Iron Pipe Company at Birmingham, Ala., which has been in operation since November, 1927.

The conditions of operation are rather trying from the cupola standpoint, as it is demanded

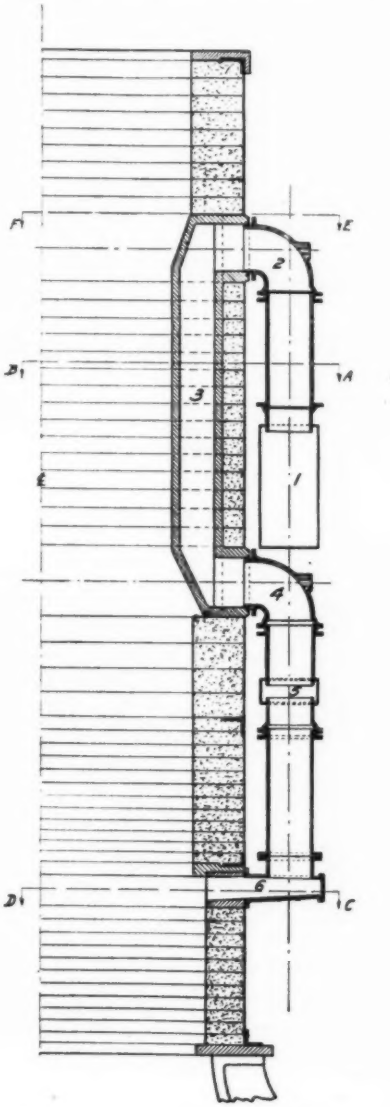

FIG. 1.—VERTICAL SECTION OF HOT-BLAST CUPOLA.

that the cupolas furnish maximum speed at some times, while at other times they are required to "stand-by," and after a shut down it is necessary that the first ladle shall contain hot metal. This requirement is primarily responsible for a rather heavy coke burden and equipment for producing high blast, as it is found that with high blast and heavy coke burden this condition can be met.

As the foundry increased its capacity, however, it was apparent that the cold-blast cupola must either have the coke reduced to where it could not stand a long shut down, or else some better means be found for producing high temperatures. After a careful survey of existing installations it was decided that these were not suitable, either on account of the excessive amount of space and equipment required, or from other standpoints.

The idea of suspending vertical pipe through the abrasion zone of the cupola, blowing the wind in at the top and out through the bottom, one pipe to each tuyere, presented itself, and original experiments were made to see how far down ordinary cast-iron pipe would stand in the cupolas under discussion. This level being at about 6 ft., it was decided to put in a trial installation, which was done in November, 1927. This original installation proved so successful in operation that three of the seven stacks of the company were converted to hot blast at the end of that year, and have been operating continuously on that basis ever since.

Details of Installation.

The cupola is shown in Fig. 1, which gives a vertical cross-section of one wall of the cupola through the casting. Wind comes in at the bustle pipe (1), passes through a riser and a

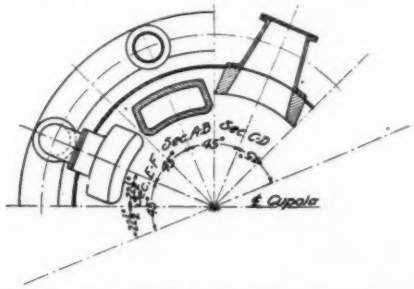

FIG. 2.—CROSS-SECTION OF PORTIONS OF THE CUPOLA.

flanged elbow (2) to the casting (3). This casting is made of cast iron, 1¼ in. thick, and the space between it and the shell is lined with 4-in. cupola blocks, the front part of the castings forming the abrasion zone of the cupola. The wind then passes through another L (4) into a distributor (5) which runs all around the cupola and serves to keep some air flowing through the casting, even if the particular tuyere is stopped. It then comes on down through the tube and into the tuyere at (6).

The plan of the 72-in. cupola is shown in Fig. 2, which gives views at the planes indicated. Beginning at section *EF* and continuing up above the charging door, the lining is of iron brick, which, with the hot-blast equipment, does not get such extreme temperature conditions as one does with the old firebrick lining. One of the strong points of this installation is the fact that it saves the wear on firebrick in the charging zone and abrasion zone.

The casting shown in Fig. 1 is the result of considerable experimentation. The first casting tried was rather too severe in corners, angles, etc., and it will be noted that the present model has rather easy curvatures. In fact, it is shown a little more sharply than it is actually made in the foundry. A good many varieties of cast iron were used, and also some heat-resisting steel. However, the steel soon warped, due to the great difference in temperatures between the front and back, and it did not give nearly as good service as the plain cast iron. At present the iron which seems to give the best results is one of approximately the same composition as ingot moulds—low silicon, high carbon, low phosphorus. The average life of the present castings is approximately 75 heats of 20 hrs. each. When the scheme was first proposed, it was considered that if only 25 heats were obtained from these castings it would be well worth the trouble.

Comparison of Cold- and Hot-Blast Performance.

To illustrate the relative performance of the cupolas before and after the installation of the hot-blast device, the author has selected two long heats, and has illustrated by means of the graph the process of the campaign. In Fig. 3 it will be noted that the cold-blast cupola, running on a coke ratio of 7½ to 1 in order to produce the 18 tons required, had to be blown at a blast well in excess of 20 ozs. In fact, the average

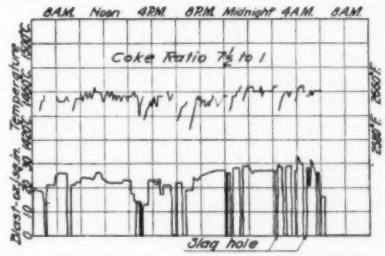

FIG. 3.—SHOWING 24-HR. HEAT ON COLD-BLAST CUPOLA, WITH MELTING RATIO OF APPROXIMATELY 18 TONS PER HR.

would probably approximate 24 ozs. The temperature in the meanwhile was keeping between 1,450 and 1,460 deg. C., with frequent dips to 1,440 deg. C., and, in the case of two considerable periods, dropped below 1,430 deg. C., which is too low for the work, and one ladle had to be pigged. It will also be noted that, due to the high blast pressure after 20 hrs., a slag hole blew out and the new one only ran 2 hrs. before it also had to be replaced.

Turning to Fig. 4, which illustrates a heat on the hot-blast cupola, the coke ratio being 9½ to 10 to 1, it will be observed that the melting rate of 20 tons (approximately 2 tons better than the cold-blast heat) was easily obtained with a blast pressure of 20 ozs. or lower. In fact, the average for the heat probably would be 19 ozs. The temperature here shows a decidedly better average,

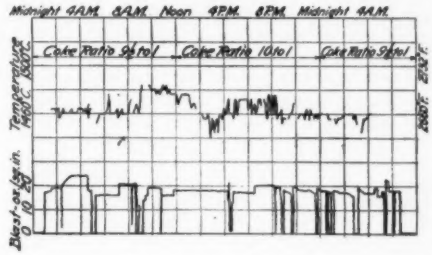

FIG. 4.—SHOWING 29-HR. HEAT ON HOT-BLAST CUPOLA, WITH MELTING RATE OF APPROXIMATELY 20 TONS PER HR.

keeping well over the 1,460 deg. C. line, except for one hour—from 3 to 4 p.m. Here the two pyrometer readers, who read alternately, seem to be unable to agree, the average being about 1,450 deg. C., against a minimum of 1,440 deg. C. One ladle, after a 30-min. shut down at 3 a.m., again read below 1,450 deg. C., but the iron quickly pulled up and reached 1,460 deg. on the second ladle.

Six-Month Record of Smooth Operation.

A record of the six months immediately preceding the installation of the hot blast, and for

(*Concluded on page* 166.)

* Paper read before the American Foundrymen's Association.

† Metallurgist, American Cast Iron Pipe Company.

1 Vial, F. K., "The Hot-Blast Cupola." "Iron and Steel" (Transactions, A.I.M.E.) Vol. 51, No. 8, January-April, 1929, pp. 21-30.

Tin Prospects.

By "Onlooker."

Tin, after many ups and downs during the course of the present year, seems at length to be on the way towards a better price level, and recently the forward position has advanced to £124 per ton. Remembering that, only a few months ago, there appeared to be every prospect of the quotation falling to below £100, the advance made is not inconsiderable. Unlike copper and spelter, tin has not created any new records, for in the 'seventies the metal fell to but little above £50 per ton, and for a number of years failed to rise above £100, but had not steps been taken to limit production it is quite certain that 1931 would have seen tin somewhere in the neighbourhood of £80 per ton.

The period of high prices in tin was characterised by a steady increase in total visible supplies, particularly noticeable in the growth of warehouse stocks in this country, and the resistance offered by the producers to any scaling down of price in the face of a declining demand was responsible for still further additions to the reserve of unsold metal. From time to time financial groups endeavoured to arrest the fall in values by carrying a large proportion of the surplus material, but finally these arrangements broke down and the flight from stability continued. It is all very well to hold metal off the market, but tonnage so earmarked cannot be spirited away, and its presence, although temporarily pushed into the background, must continue to depress values.

During the past two years, various arguments have been put forward to prove that tin cannot possibly be produced profitably below £100 per ton. Figures, it is said, can be made to prove anything, but it has yet to be proved that tin mines were losing money during the lean periods in the second half of the nineteenth century. Production continued for a number of years with the quotation well under the £100 mark, and, although it may be argued that wages and other items may be a bigger burden to-day than they were fifty years ago, it cannot be denied that mining engineering and metallurgy have made big strides and thus cheapened the product.

Recent events in tin have shown, however, that the big interests were not satisfied to await the normal working out of economic problems, but decided to compel an advance first by means of restriction operating through a quota scheme and secondly, with the aid of a world tin pool, which would hold in bond as a kind of hostage for the return of a higher price, the world's excess tonnage. The immediate result of these decisions, first the quota scheme and then the pool, was to compel a sharp advance in values, while scattered buying by consumers, both in Europe and America, resulted. Much of the upward swing has, however, proved to be due to speculation, and, as a result, profit taking supervened, a setback followed and confidence was shaken. Since it has been stated that £150 per ton is the goal aimed at by the committee, it is not surprising to find consumers nervous and speculators on the *qui vive*. Such a situation is not, however, a healthy one.

The values of practically all the metals are at present depressed, and if natural economic laws are allowed to operate, their recovery can hardly fail to be slow, for the upward swing of the trade pendulum is likely to be a gradual affair. Quite contrary to these laws of supply and demand, particular action has been taken to engineer a sharp advance, as a result of which the quotation to-day stands at a level out of relation to demand. Will consumption catch up? The mere fact that the price has advanced is against the likelihood of such a development and the probability is that usage will be curtailed.

Experience shows that however carefully planned schemes of price advancement may be, weakness develops at the production end as soon as anything approaching stability at a higher level is secured. Little by little output increases until the final collapse comes, and the last state is indeed worse than the first. It is hoped that tin will escape the evils usually attendant upon schemes of artificial price aggrandisement.

A Record Contract.

The largest order for coal conveyors that has ever been placed has been received by Messrs. Mavor & Coulson, Limited, the Glasgow firm of engineers and ironfounders. It is understood that the contract is for 40 machines of a total value of £40,000. The cheering intimation of this contract was made by Mr. Sam Mavor, of the firm, at a "family party" given to the employees in the St. Andrew's Halls, Glasgow, by the directors to celebrate the firm's jubilee. Mr. Mavor said: "We have more work in hand at this moment than ever before"; he also stated that the firm had had many ups and downs, but they had more ups than downs. They were not merely a producing machine, they were something of an institution which attracted to them good men. Many of their "old boys" had taken prominent positions at home and abroad. It gave them great pride that three of their "old boys" were at the top of the profession.

Mr. G. Carrick Anderson, in presenting Mr. Mavor with his portrait in oils, said that the firm had established business connections in nearly every country in the world, and it was due to the energy and foresight of Mr. Mavor than many of them were earning a living to-day. Mr. W. Arthur Coulson was presented with a Royal Doulton dinner set from the employees by Mr. Archibald Boag.

Publication Received.

Aluminium in Electrical Engineering.—Published by the British Aluminium Company, Limited, Adelaide House, King William Street, London, E.C.4.

Through the publication of their recent brochures, the British Aluminium Company has done a real service to the foundry industry, and the one under review is easily the best from this particular angle. It shows the foundrymen just what alloys are available and their physical properties; it outlines for the salesman his arguments, and finally it indicates to the aluminium foundry owner the nature of vast fields for his products. Covered with stiff cardbox backs, and containing 36 pages, the brochure is well illustrated with 42 pictures. A curious feature of this work is that on the last page we are told that the contents cover a lecture by Mr. E. T. Painton; surely this information ought to appear at the beginning, together with the name of the institution sponsoring it. We strongly advise our readers to procure a copy of this brochure, and see that it is perused by both the technical and sales staffs.

Iron and Steel Production.

The National Federation of Iron and Steel Manufacturers, in their Statistical Bulletin for July, state that, although July contained one more day than June, the production of pig-iron declined still further, and amounted to 317,000 tons only, compared with 323,800 tons last June and 486,100 tons in July last year. There was a net decline in the number of furnaces blowing of six, reducing the number in operation to 70, which is lower than at any time since the resumption after the stoppage of 1926. Steel production totalled 428,700 tons, or practically the same as in June.

Recent Extensions to the Foundry of John Harper & Company, Limited, Willenhall.

(*Concluded from page* 164.)

credited to each moulder. The inspected material is then handled *en route* by 24 double-ended grinders, fitted with efficient dust exhausters. This shop is shown in Fig. 4 and in the background of Fig. 5. All the conveyors terminate in a turn-table, which permits of diverting the castings straight to their despatch by the firm's own motor lorry service to all parts of England, or to the stores, where minimum but still important stocks are carried for the larger buyers, or to the enamelling or further treatment departments.

Heating and Lighting.

At the time of our visit an important and extensive Sturtevant Plenum plant was being installed, which will pump air, either cool or heated, to each moulding station. No less than 100,000 cub. ft. of air per min. is to be delivered. This, together with a unified lighting of 6-ft. candles intensity, should make for as near ideal working conditions as industry can give. We congratulate the directors and technical staff on their successful effort to combine manufacturing efficiency with the maintenance of the highest grade of quality.

The Moore Hot-Blast Cupola.

(*Concluded from page* 165.)

the six months immediately following the completion of the hot-blast installation, is shown in Table I. The figures show beyond a doubt the smoothness of operation obtained by the use of the hot blast. Troubles from bridging and consequent increasing of blast pressure change from a serious problem to a minor worry.

Temperatures which, with the cold blast, were constantly dipping below the danger line, are easily maintained at the proper point with the hot blast, and even the dips are still in the region of good iron. While the blast temperature in this type of installation will not average over 150 deg. C.—in fact, in cold weather does not exceed 135 deg. C.—it is believed that the point of maximum benefit is the boiling point of water, 100 deg. C., and that after that the increase is linearly with the temperature. It will be conceded that if the cupola blast were heated to the ignition point of the coke—in the neighbourhood of 590 deg. C.—no bridging would be likely to occur, and that the blast pressures could be increased tremendously. This is not feasible in this type of operation, although it is thought that any heat of 6 hrs. or over should be run on the hot blast.

Table I.—*Comparison of Cold-Blast and Hot-Blast Cupola Operation for a Six-Month Period.*

	Cold blast.	Hot blast.
Ratio of iron to coke	7.1 to 1	10.4 to 1
Average No. of pipes cast per shift	386	501
Total delays charged to iron, approximate hrs.	55.5	4.5
No. of times cold iron reported	7	1
No. of times iron reported slow with no actual delay	22	3
Average blast pressure	20 ozs.	14 ozs.
Average melting rate per hr. ..	20 tons	25 tons
Average length of heat	12 hrs.	18 hrs.

Chromium Plating and Heat Treatment.—According to an article in a recent issue of "The Iron Age," the corrosion-resistance of chromium-plated parts can be increased about seven fold (as revealed by a calcium-chloride salt-spray test) by submitting them to a low-temperature heat treatment. The treatment suggested is 450 deg. Fah. for 30 mins.

The "Dinta" System.

By A. Marson.

[*The author of this Paper won a competition which enabled him during a visit to the Continent to study the D.I.N.T.A. system of education. This movement is creating great interest throughout the world on account of its logical application to post-war German industrial conditions.*]

This training scheme is the outcome of an industrial educational association. It is quite distinct from State education, and has had remarkable success. Its ideal, that of giving man his true place in industry, is a good one, and one would do well to accept it. The most important part of industry is man, and if we do not have the cordial support of the workmen, of what avail is the most scientific equipment? The German owners and managers held a meeting in 1925 to consider the position, and the "Dinta" training scheme was the result. Assuming that the task of industry is to produce goods cheaply, the organisation had to be adapted to this principle. As a contribution to the mechanisation, and rationalisation of the plant, the education of the workman is of great importance. It is right in principle to mechanise the plant as much as possible in order to place all workers in the sphere of brain workers, as distinct from muscle workers. When, thousands of years ago, the Pyramids had to be built, the manpower of slaves was the only possible power available. But now if a firm had to build the Pyramids, it would call in the assistance of the crane and the locomotive, so that really the worker would not be an animal only, but a brain worker, using machanical tools instead of his hands.

Effect of Rationalisation in Germany.

To come to modern times, in Germany great strides have been made in the mechanisation of industry. In 1913 only 5 per cent. of the work was done by machinery, and 95 per cent. by human power. Whilst in 1929 the figures were reversed, and 95 per cent. was done by machinery and 5 per cent. by human power. This change has made the German worker a user of brain instead of muscle. The other way to develop industry is by way of rationalisation, but this is a source of constant dispute. Some see in it a way to happier times, whilst others believe it to be the first step to the end of Western civilisation. For instance, in Russia one learns that mechanisation and rationalisation have become a fanatical belief. Also, people who never saw industry write about rationalisation as the root of all evil. Yet real rationalisation cannot but mean a well-thought-out method of forming and carrying out of the work of mankind. It is said that in a rationalised industry not a step is taken uselessly. The work should be done in harmony and rhythm, which really helps, and makes labour more productive. Useless bending or reaching is avoided, and the worker should have a seat wherever possible, thus saving man power. A reasonable organisation of production is essential, as it will normalise production. It is surely an error that rationalisation should or will make man take the part of a mute person. On the other hand, man must become master of the whole situation.

A Cultural Movement.

Real mechanisation or rationalisation must include the highest culture of the working man. He must become the machine master, and not a machine slave. True, to-day, many men, some workers and some directors, are run by the work they do instead of the reverse. What can industry do to make the human factor the real actors in the play? The first thing to do is to make them know the technical part of their work as completely as possible. All men should know their process so well that machines should give them the creative spirit. Man should never be under the machine, but over it. When a man understands the whole process in his factory, then only can he have the creative spirit.

It has been an axiom during the last twenty years, that the only way to make a man happy is to cut down his hours of work, and give him as much money as possible, in order for him to find happiness outside his work, after work hours, in pleasure. This idea is fundamentally wrong, and one must try to give back to man the feeling that the real source of human happiness is in some kind of creative activity. If it can be forgotten that man has to earn his living and work be allowed to take the place of some of the present pleasures, then there is some hope of happiness. Man is not only a body, but has ideas, instincts and desires. These must be satisfied somehow, and if they are not satisfied at work they must be satisfied in some other way.

Vocational Training as First Step.

The above is an explanation of the reason for the existence of the "Dinta" and its aims. The commencement of the practical part of the scheme is with youthful entrants into industry. The first task is to ascertain if their talents are in agreement with their professional wishes. Unless this is done, no person can ever reach a high standard of efficiency in his profession. School certificates are not conclusive test of a man's ability, so they have to turn to Science to help them in the choice. If a boy works quickly and another works exactly and cautiously, then evidently one is destined to be a brain worker, and the other a manipulative worker. Once the qualifications of a young man have been determined he is not put into the workshops at once, but first has opportunities of finding out all about the raw materials, the kind of machinery, and the history and tradition of the individual plants of the industry he is to enter. Excursions are made by a party of boys, under elder members of the staff in order to gather knowledge of the men they will have to work with. An apprentice shop is the means of the first introduction into industry. All the boys are together in one building. There are three aims of these apprentice shops. The first, to give a boy a good knowledge of the technical tools with which he will have to work. This is important because a country always must give the best knowledge to its youth, in order to have a tradition carried on. The second aim is to educate the boy, not to be a specialist in one class of work, but a versatile worker, who can adapt himself to a new job. The third aim is to make the men happy, have a sound body, and a sound mind and to take an interest in the success of his country and not be a disinherited member of society.

A Practical Beginning.

The "Dinta" scheme always teaches all the boys a manipulative thing first. There are 10,000 boys under its supervision, and each boy has to go through a course of carpentering, blacksmithing and fitting. This fits all the boys, after a two years' course, for learning their own profession. Also the apprenticeship workshops are small economic units of their own and must pay for themselves. On their own account they pay wages, buy raw materials and sell their products. This method gives the young men an inside knowledge of the plant and gives them a knowledge that every plant must be self-supporting. If the individual plants are not large enough to have a workshop for the apprentices, an association of, say 20 plants, on a co-operative basis, is organised, and the boys spend two years in the co-operative workshop before joining their own plant. This also tends to give all the boys professional pride and an interest in themselves and make them locally patriotic. When the apprentice leaves the special workshop he enters the general workshop. Here he is under special supervision, and every six months he is tested to see how far and in what direction he has developed his abilities and to test his power of making practical use of his craft. At the end of his apprenticeship, which usually lasts four years, an examinaion takes place. This is practical, written and oral. If the youth is successful, a small gathering is held and the young man is given a testimonial and an initiation in the same way as a journeyman was treated by the old Guilds.

Opportunities for Physical Training.

During the four years' training one whole day per week is spent at school, where technical knowledge is given. In addition to this, there is a third kind of training, that of character. This is done in leisure time and is developed by means of gymnastic clubs, swimming, etc. In addition, the "Fellowship" and "Club" idea is strongly encouraged. Once a year each young man has a fortnight's tour through the country. This is usually a walking tour. Also as many of the boys as possible are taken to the Baltic and so have a trip to sea. A similar kind of training is afforded the unskilled worker.

Aged and Clerical Workers Embraced.

Recently the "Dinta" inaugurated a similar training for clerical workers. The boys have two to three months in a workshop of their own, doing the same manipulative work as the other "craft" boys, and then proceed to the warehouse and stores. They also follow all the manual labour done in the plant. This gives each boy a knowledge of the whole concern. There is not one important plant in the whole of Germany which has not adopted the "Dinta" principle. Also the important step of a supplementary training to the adult workers has been made. This was more difficult than the scheme for the boys, but it has been achieved. The first thing done in any plant is to find the crucial points and to see if a higher standard of technical efficiency is possible. The physical and psychological points of view are considered. The transfer of men from job to job is considered and special training is given them during the change. The question of making men more comfortable in their work is also considered. And the question of payment for a given post is thought out. The most useful point is the mental guidance of the adults by means of works' newspapers. Then, to lessen the mental difficulties of the workers, the question of houses and home are considered. A highly-trained lady is attached to each plant, and she gives advice in cases of home troubles. The aged workers work in special workshops of their own. This is done to preserve, as far as possible, the idea of independence among the older men and have them feel that they are still useful members of society. Another important part of the "Dinta" work is the training it gives to the managerial staffs of associated works. A course on management is given to the higher-grade members of a staff in order to assist them to work in a co-operative spirit. The "Dinta" also gives courses to University students who wish to enter industry. The course is one on how to treat and guide men, and is also attended by managers, every Saturday.

Inter-Relationship.

The important factor about the "Dinta" is that it is trying to train men more efficiently for industry and that it is the realisation that man is more important than machinery and capital, with which he is associated in modern industry. The increase in the willingness shown by the workers has amply justified the setting up of these schools by the German industrialists. Also, as Germany must compete in the world

(*Concluded on page* 168.)

Trade Talk.

The weekly meetings of the London Iron and Steel Exchange were resumed at the Cannon Street Hotel, London, last Tuesday.

Messrs. Hughes, Bolckow & Company, Limited, shipbreakers, of Blyth, have secured the Spanish steamer "Emilia de Perez" (3,800 tons) for breaking-up purposes.

Messrs. William Jacks & Company announce that the address of their Birmingham office has been changed from 18, Bennett's Hill to Clarence Chambers, 39, Corporation Street.

Orders for stainless steel, of a value of approximately £20,000, have been placed with Messrs. Thos. Firth & John Brown, Limited, Sheffield, by the Soviet Government.

The Blue Star liner "Stuart Star" is expected in the Tyne shortly to undergo conversion from coal to oil-burning equipment at the Walker Yard of Messrs. Vickers-Armstrongs, Limited.

Messrs. Smith, Patterson & Company, Limited, Pioneer Foundry, Blaydon-on-Tyne, have just completed the first unit of a contract for six mechanical stokers for the Battersea Power Station.

A company is to be formed in Prague by the Czeskomoravska Company, the firm Löwig & Taussig and the Tube Works Company, for the marketing of cast-iron pipes. The share capital is to be 1,000,000 Czech crowns.

Messrs. Dorman, Long & Company, Limited, of Port Clarence, Middlesbrough, and the Tees-side Bridge & Engineering Company have received from Messrs. Simon Carves, Limited, of Manchester, an order for 5,000 tons of grey-iron castings.

A report from Prague states that 13 express locomotives ordered from the Skoda Works, in Pilsen, for British India have been tested and have given satisfaction. The same works have now received another order, this time for 14 goods engines, for British India.

Booth & Brookes, Limited, Mildmay Ironworks, Burnham-on-Crouch, Essex, are at present engaged on the production of a rustless metal, which they hope to manufacture in large quantities in the near future. It involves an entirely new process, and it is thought that the castings turned out will be very much cheaper than the present stainless-steel variety.

Messrs. Dorman, Long & Company, Limited, have opened a branch office at Royal Insurance Buildings, Grey Street, Newcastle-upon-Tyne. Sir Alexander Leith, of the firm of Alexander Leith & Company, 25, Collingwood Street, Newcastle-upon-Tyne, who for upwards of 45 years have been the company's agents in the Tyne and Wear districts, will continue his association with the company.

The members of the Ferro-Silicon Syndicate (with offices in Vienna), which has been extended to the end of 1931, will hold a meeting during the next few weeks, in order to come to a decision regarding the definitive renewal of the cartel. Although the cartel's prices have been underbidden during the last few months and competition between the cartel and outside works shows a tendency to increase, it is expected that the Syndicate will be further prolonged beyond 1931. In spite of the unfavourable situation of the iron and steel market, the demand for ferro-silicon has been fair lately. Germany, particularly, has been a good buyer. Prices, however, show a weak tendency.

The immediate outlook in the Clyde shipbuilding industry is slightly better, a number of new contracts having been placed during the past month. One vessel, the P. and O. liner "Carthage," of 14,000 tons gross, constituted the total output from the yards during the month of August. In the corresponding period of last year the output was 19 vessels, aggregating 59,531 tons. The orders recently placed include two cargo vessels of 9,000 tons each and a 6,000-ton fruit carrier, to be built by Messrs. Lithgows, Limited, at Port Glasgow; an L.M.S. cargo and cattle boat for service on the Holyhead-Dublin route, booked by Messrs. Denny Bros. & Company, Limited, Dumbarton; two coasting steamers which Messrs. Scott & Sons, Limited, Bowling, are to build; an order received by Messrs. Harland & Wolff, Limited, Govan, from a Carlisle company for a twin-screw pontoon barge; and a contract for a dredger placed by London owners with Messrs. Ferguson Bros., Port Glasgow.

When drilling laminated bakelite, the drill should be sharpened slightly off centre. This will give a hole of the correct size and prevent the drill binding.

Personal.

On August 28, in the board room of Colvilles, Limited, Mr. D. R. Lockhart, Mr. William Watson and Mr. W. C. Blackstock were made the recipients of presentations on the occasion of their retiral. Mr. John Craig, C.B.E., chairman and managing director, presided, and in making the presentations referred to the long and faithful services of the three recipients. Mr. Lockhart, whose record of service was 50 years, received a wireless set; Mr. Watson, who had 49 years' service, and Mr. Blackstock, received wallets of Treasury notes.

The Hon. J. M. W. North has succeeded Mr. H. Shannon as director of Ealing Park Foundry Company, Limited, Junction Road, South Ealing, London. Mr. North, who is the second son of the Earl of Guildford, was originally trained for a naval career at Osborne and Dartmouth. He was, during this period, attracted to foundry work, and as a result he served his apprenticeship under Mr. George Edgington at Messrs. Markham & Company, Limited, at Chesterfield. Later he was transferred to the foundries of the Staveley Coal & Iron Company, Limited, where he reorganised the special pipe foundries at the New Works. In 1929, he commenced studying the potentialities of centrifugally-casting pipe, utilising a sand lining to the moulds. This business took him twice to America, and to Germany and France. Finally he was responsible for the lay-out of Staveley's already famous sand-spun pipe foundry. Mr. North has always taken a serious interest in the technical side of foundry practice, and joined the Institute of British Foundrymen in 1923. Last year he presided with distinction over the Sheffield Section. Ealing Park Foundry, the concern with which he is now connected, was established shortly after the war, and it has acquired a national reputation as manufacturers of alloy and high-grade grey-iron castings, in both the jobbing and repetition lines. Recently the firm has acquired the sole British and Dominion rights for the sale of the well-known Utard range of foundry machinery.

The Hon. J. M. W. North.

Wills.

Gilbert, J., metal merchant, of Brondesbury	£21,204
Bengough, Cyril F., late chief engineer of the L.N.E.R.	£15,164
Simpson, Robert, civil engineer, Pollokshields, Glasgow	£115,525
Prest, Stanley F., chairman of Parsons Marine Steam Turbine Company, Limited, and of C. A. Parsons & Company, Limited	£85,276

Obituary.

Colonel John Lynn Marr, a director of two Wearside shipbuilding firms and of the Sunderland Forge & Engineering Company, Limited, died on September 2 at the age of 54. He was the only son of Sir James Marr, Bt.

Mr. Thomas Blackadder, who was killed whilst on holiday at Rothesay on August 29, was a native of Falkirk. He served his apprenticeship in the electrical engineering department of the Falkirk Iron Company, Limited, and at the time of his death was assistant electrical engineer with British Baths, Limited, Greenford, Middlesex.

We regret to announce the death of Mr. F. Sanderson, of Gateshead-on-Tyne, which occurred on September 4, after a long illness. For many years Mr. Sanderson was a partner in the firm of Lawson, Walton & Company, suppliers of foundry requisites, and until a few months ago was hon. secretary of the Newcastle Branch of the Institute of British Foundrymen. He was also a member of the General Council of that body, and a member of the Finance Committee.

Sir Thomas Ernest Stanton, superintendent of the Engineering Department of the National Physical Laboratory, Teddington, died recently. From 1891 to 1896 he was employed as demonstrator in the Whitworth laboratory of Manchester University, and from 1896 to 1899 he was senior lecturer in engineering at University College, Liverpool. He then went to Bristol, where he was Professor of Civil and Mechanical Engineering at University College for two years, and in 1901 he was appointed superintendent of the Engineering Department of the National Physical Laboratory. Admitted a Fellow of the Royal Society in 1914, he was knighted in 1928. He was the author of a book on friction and a number of papers on heat transmission, wind pressure, and the fatigue of materials.

New Companies.

Staffordshire Edge Tool Company, Limited.—Capital £10,000. Directors: P. J. Colyer, Silverdale, Pedmore, Stourbridge, and B. G. Colyer.

Roberts & Company (Wednesbury), Limited, District Forging Works, Franchise Street, Wednesbury.—Capital £5,000. Light constructional engineers, etc. Directors: E. Roberts and A. H. Hill.

Iron Roads, Limited.—Capital £5,000 in £1 shares. Manufacturers of metal blocks for road making, etc. Directors: F. Hough, H. G. Henly, A. G. Hunt, F. G. Small and A. G. Pears. Solicitors: Simon, Haynes, Barlas & Ireland, 117-123, Great Portland Street, London, W.

The "Dinta" System.

(*Concluded from page* 167.)

markets to live and pay war debts, the claim was made by Dr. Arnold, of the Düsseldorf Training College, that the increase in the economic power of the country was essential.

Dr. Arnold, in an interview, stated:—

(1) The "Dinta" was created by industry to stop subsidies from public funds being used in industry. Much of the money necessary to run the "Dinta" comes as profit from its newspapers. It sells a million each week.

(2) He admitted that Germany's increased industrial efficiency would react on Great Britain and other industrial nations.

(3) He said that the versatile worker, as distinct from the specialist, was Germany's aim.

(4) The Russians have the "Dinta" scheme working, and the Dutch, and last year the Federation of British Industries inquired into the scheme.

(5) The trade unions refused to co-operate at first, but now were doing so.

(6) The Marxian trade unions still refused, but say that once the plant becomes theirs they too will use it.

(7) The non-political trade unions help, as they see some good points from the workers' viewpoint.

ECONOMICAL SERVICE

FLUXITOL

SAVES UP TO 50% IN RUNNERS AND HEADS.

A Black Powder to be applied to the surface of the molten metal in heads and risers of Iron and Steel Castings or Ingots.

CUPOLINE

THE REFRACTORY LINING.

FINITOL

Used in Powder Form for dusting, or as Paint for dry Moulds, for fine surface finish of Castings, &c.

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A. H. ACKROYD,

White Cottage, Park Road,

Timperley, CHES.

Telephone : Sale 1291.

Iron and Steel Markets.

Pig-Iron.

MIDDLESBROUGH.—There was a rather better feeling in evidence at the meeting of the Cleveland iron market on Tuesday. The holidays being now definitely over, deliveries to local and Scottish consumers have been resumed, although these deliveries are by no means as large as is desired. The demand for Cleveland iron for export remains limited, but it is satisfactory to note that at present home producers appear to be unchallenged in their own market. In Scotland, Continental iron is still upon the market, but many of the foundrymen prefer to buy the dearer Cleveland material, on the ground that the foreign product is often unreliable, producing faulty castings. If Cleveland makers can retain their home market unchallenged, at the present rate of demand, an impression should soon be made on stocks. Prices are unchanged :—No. 1 Cleveland foundry iron, 61s. per ton; No. 3 Cleveland G.M.B., 58s. 6d.; No. 4 foundry, 57s. 6d.; and No. 4 forge, 57s. per ton.

The situation in the East Coast hematite market has not improved, but the demand is sufficient to absorb the present output. A few orders from Sheffield and the Midlands have been reported, and several export sales have been concluded. Consumers are more inclined to enter into forward contracts. The price of East Coast mixed numbers is now 60s. On the West Coast business remains limited, but makers are more optimistic regarding the future. There are only three furnaces still in blast, one of which changed over to spiegeleisen last week, for which product there is a temporary demand. It is thought that consumption will shortly improve, especially when the Workington steelworks reopen at the end of September, as is hoped.

LANCASHIRE.—An increased number of orders is reported by some pig-iron producers. Several Lancashire foundries, which have satisfactory orderbooks, are covering their requirements for the next few months. The bulk of the buying, however, remains on a short-term basis. For delivery to users in the Manchester price zone, Staffordshire, Derbyshire and North-East Coast brands of No. 3 iron remain at 67s. per ton, with Northamptonshire foundry iron at 65s. 6d., Derbyshire forge at 62s., Scottish No. 3 at 86s. to 87s., and West Coast hematite iron at about 80s. 6d. per ton.

MIDLANDS.—The market remains quiet, but some expansion in business is anticipated during the next two or three weeks. Here and there, there are some signs of a revival in the demand, but business in general remains limited, and buyers are still covering only their immediate demands. For delivery to Birmingham and Black Country stations, the furnaces continue to quote 62s. 6d. for Northants No. 3 and 66s. for Derbyshire, North Staffordshire and Lincolnshire No. 3.

SCOTLAND.—Business remains limited, the recent reductions in the price of Scottish pig-iron having had little effect upon the demand. The foundries continue to buy only the smallest quantities for immediate delivery. The price of No. 3 foundry, f.o.t. furnaces, remains at the reduced figure of 69s. 6d. per ton, and No. 1 at 72s. per ton. Continental No. 3 is obtainable at 52s. 6d. to 53s., f.o.t. Grangemouth, with Middlesbrough No. 3 at 58s. at Grangemouth.

Finished Iron.

The position in the finished-iron market remains very unsatisfactory, none of the mills having sufficient orders to warrant them working full time. Staffordshire crown iron varies from £9 5s. to £10, with nut and bolt iron at from £8 5s. to £8 10s., makers of the latter, however, meeting with severe competition from abroad. The price of Staffordshire marked bars is maintained at £12 per ton at works.

Steel.

The market for finished steel has improved somewhat, and several new inquiries have been reported. It is thought that more orders may be forthcoming when the Government's intentions are more fully understood and confidence is restored to industry. The steelworks remain very much in need of new orders. The market for Continental semi-finished steel is much firmer, and, in view of the present low level of prices, some upward movement may be expected. However, purchases are limited, in view of the poor position of the finished trades.

Scrap.

There is hardly any business passing in the Cleveland scrap market, and not one of the big steelworks is buying heavy steel scrap. Merchants, however, refuse to reduce prices. Cast-iron scrap remains at 40s. per ton for ordinary quality and 42s. for good machinery quality. The Midlands market continues to be lifeless. Very few new orders are being given out, and buyers have difficulty in getting instructions to make deliveries in fulfilment of present contracts. Heavy cast-iron machinery scrap in cupola sizes remains at 45s. to 47s. 6d., delivered, and light cast-iron scrap at 37s. 6d. per ton, delivered. The South Wales scrap market remains very slow. The Scottish market is quiet, little new business passing. Cast-iron machinery scrap is at about 46s. to 47s. 6d. per ton, and ordinary cast iron, in pieces not exceeding 1 cwt., is quoted at about 40s. to 41s. 3d.

Metals.

Copper.—There is very little business passing between the producers and the consumers, neither being very eager to trade. Buyers are largely influenced by thought of the large stocks of unsold material, while sellers do not see that any large influx of orders would result from a reduction in the existing price level. It is impossible for the present impasse to last much longer. An important meeting of the American producers is to be held shortly, and the results will be anxiously awaited. On Wednesday official prices fell over 15s. for cash, to £30 11s. 3d., and the forward quotation lost nearly 17s., ending at £31 6s. 3d. This is a new low record for the price of standard copper.

Closing quotations :—

Cash.—Thursday, £32 10s. to £32 11s. 3d.; Friday, £32 3s. 9d. to £32 5s.; Monday, £31 10s. to £31 11s. 3d.; Tuesday, £31 6s. 3d. to £31 7s. 6d.; Wednesday, £30 11s. 3d. to £30 12s. 6d.

Three Months. — Thursday, £33 6s. 3d. to £33 7s. 6d.; Friday, £33 to £33 2s. 6d.; Monday, £32 7s. 6d. to £32 8s. 9d.; Tuesday, £32 3s. 9d. to £32 5s.; Wednesday, £31 6s. 3d. to £31 8s. 9d.

Tin.—The demand for tin is very poor and the present position remains unsatisfactory. Speculations are already being made as to the nature of the September figures. It is thought that they will still reveal the existence of heavy stocks, but that the latter will gradually be absorbed by the end of the year, as the restriction scheme comes into fuller effect. In America, the expected autumnal demand, particularly in the canning industry, has not fully materialised, and no extensive reductions are being made of the existing stocks. The situation of the producers is becoming very serious.

Official closing prices :—

Cash.—Thursday, £117 10s. to £117 12s. 6d.; Friday, £115 7s. 6d. to £115 10s.; Monday, £115 to £115 2s. 6d.; Tuesday, £114 10s. to £114 12s. 6d.; Wednesday, £113 17s. 6d. to £114.

Three Months.—Thursday, £120 to £120 2s. 6d.; Friday, £117 17s. 6d. to £118 2s. 6d.; Monday, £117 10s. to £117 12s. 6d.; Tuesday, £117 2s. 6d. to £117 5s.; Wednesday, £116 7s. 6d. to £116 10s.

Spelter.—It has only been possible to negotiate business with consumers at very reduced prices, in spite of the fact that future supplies will be on an even more limited scale than formerly. However, despite the restriction scheme, present stocks are not being fully absorbed, owing to the abnormally low level of consumption. The demand from the galvanising trade remains limited. With finance and politics in such a confused state, it is useless to attempt to make any forecasts for the future.

Daily fluctuations :—

Ordinary.—Thursday, £11 2s. 6d.; Friday, £11; Monday, £11 2s. 6d.; Tuesday, £11 1s. 3d.; Wednesday, £10 15s.

Lead.—The drastic restriction of production seems to have had little effect on the amount of the stocks in hand. Although there was a fall in prices, the demand increased somewhat this week. The cable makers in this country entered into several important contracts, and the daily sales were the largest seen for some time. There has also been an improved demand in America. This movement may indicate a general increase in consumption, but, on the other hand, may only mean that buyers are covering themselves more adequately for the autumn, as it is known that their stocks have been running low for some time.

The week's prices have been :—

Soft Foreign (Prompt).—Thursday, £11 1s. 3d.; Friday, £10 18s. 9d.; Monday, £10 18s. 9d.; Tuesday, £10 17s. 6d.; Wednesday, £10 13s. 9d.

Contracts Open.

Bangkok, Siam, November 12.—Points, crossings in 50-lb. rails, and 1,000 tons of 9-metre rails, for the Siamese State Railways. The Department of Overseas Trade. (Reference G.X. 10,701.)

Benoni, S.A., September 17.—Cables, boxes and transformers, for the Municipality of Benoni, Transvaal. The Department of Overseas Trade. (Reference A.X. 11,076.)

London, W., September 21.—Six centrifugal pumps, with motors, etc., for the Brentford and Chiswick Urban District Council. Mr. J. H. Abbott, the Sewage Works, Corney Road, Chiswick, W.4. (Fee £2 2s., returnable.)

Manchester, September 12.—2-in. dia. high-pressure steam pipes, for the Electricity Committee. Mr. H. C. Lamb, chief engineer and manager, Electricity Department, Town Hall, Manchester.

Milton, Sittingbourne, September 15.—1,670 yds. of 2-in. cast-iron pipe, for the Milton Rural District Council. Mr. L. A. Randerson, 76, High Street, Sittingbourne.

Singapore, October 19.—Malleable iron pipe fittings, etc., for the Singapore Municipality Water Department. The Department of Overseas Trade. (Reference G.X. 10,679.)

Wick, September 14.—Nine miles of cast-iron pipes, 10-in. and 8-in. dia., and under, etc., for the Wick Town Council. The Burgh Surveyor, Wick, or Messrs. Jenkins & Marr, 16, Bridge Street, Aberdeen. (Fee £5, returnable.)

CAST IRON FLANGED PIPES
2 in.–12 in. & CONNECTIONS. to 24 in. dia.
WE HAVE FIFTY-TWO YEARS OF ACCUMULATED EXPERIENCE AND METAL PATTERNS.
JAMES & RONALD RITCHIE, LTD.,
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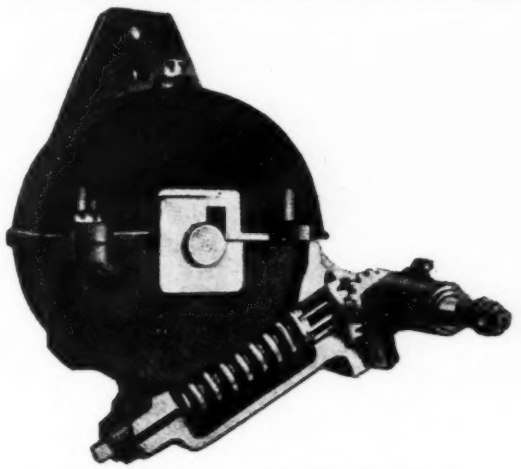
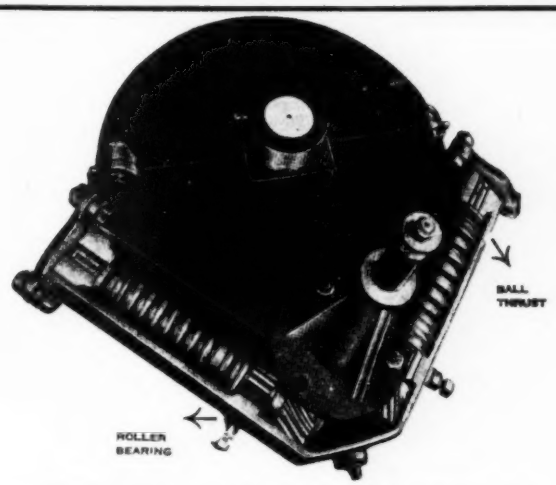
"COLLIN" LADLE TILTING GEAR.



Tilting Gear for Ladles up to 8 tons (with Worm Cover removed).



Tilting Gear for Ladles of from 8 tons to 35 tons (with Worm Covers removed).

The above illustrations show very clearly the perfection of the "COLLIN" Patent Tilting Gear. The case-hardened, special machine-cut worms work in roller bearings with ball bearings at each end to take up the thrust. The gear wheels are all machine cut and all spindles are of special steel. The gears are easily accessible and work in oil, which only needs renewing at lengthy periods, owing to the gears being totally enclosed in a strong dust-proof, oil-tight, cast-iron gear box. This gear entirely prevents sticking or overpouring.

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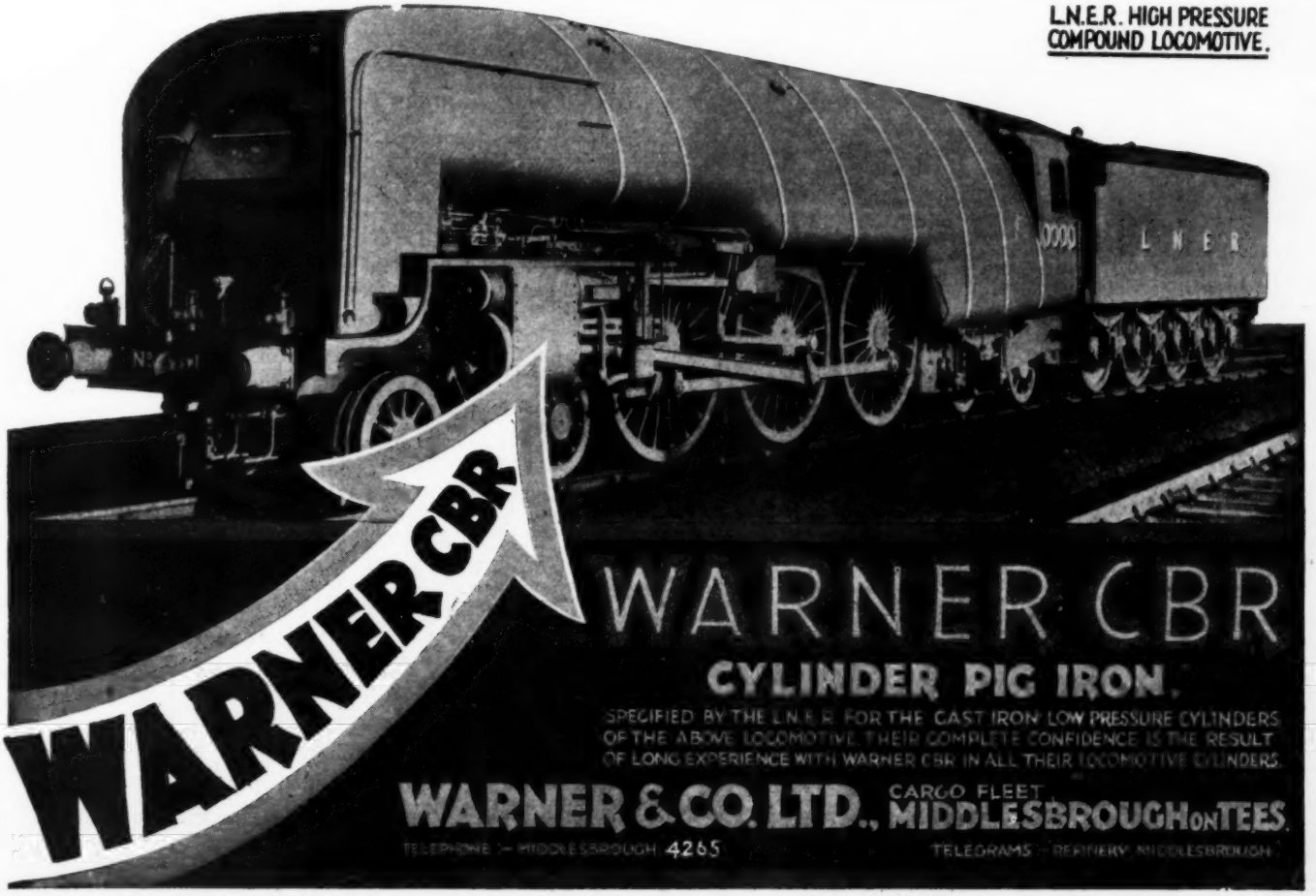
L.N.E.R. HIGH PRESSURE COMPOUND LOCOMOTIVE.



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CYLINDER PIG IRON.

SPECIFIED BY THE L.N.E.R. FOR THE CAST IRON LOW PRESSURE CYLINDERS OF THE ABOVE LOCOMOTIVE. THEIR COMPLETE CONFIDENCE IS THE RESULT OF LONG EXPERIENCE WITH WARNER CBR IN ALL THEIR LOCOMOTIVE CYLINDERS.

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WEEKLY PRICE CURRENT.

COPPER.

	£ s. d.
Standard cash	30 11 3
Three months	31 6 3
Electrolytic	34 10 0
Tough	32 0 0
Best selected	32 10 0
Sheets	64 0 0
India	44 10 0
Wire bars	37 2 6
Do., October	37 2 6
Do., November	37 2 6
Ingot bars	37 2 6
H.C. wire rods	£7 10 0
Off. av. cash, August	32 12 3
Do., 3 mths., August	33 10 0
Do., Sttlmnt., August	32 12 1½
Do., Electro, August	35 19 7½
Do., B.S., August	34 1 3
Do., wire bars, August	36 11 6
Solid drawn tubes	10d.
Brazed tubes	10d.
Wire	6½d.

BRASS.

Solid drawn tubes	9d.
Brazed tubes	11d.
Rods, drawn	7½d.
Rods, extd. or rlld.	5d.
Sheets to 10 w.g.	7½d.
Wire	7½d.
Rolled metal	6½d.
Yellow metal rods	4½d.
Do. 4 × 4 Squares	5½d.
Do. 4 × 3 Sheets	5½d.

TIN.

	£ s. d.
Standard cash	113 17 6
Three months	116 7 6
English	115 10 0
Bars	117 10 0
Straits	115 10 0
Australian	115 0 0
Eastern	119 10 0
Banca	118 15 0
Off. av. cash, August	114 19 1½
Do., 3 mths., August	117 9 4½
Do., Sttlmt., August	114 19 0

SPELTER.

	£ s. d.
Ordinary	10 15 0
Remelted	10 10 0
Hard	8 10 0
Electro 99.9	13 10 0
English	11 12 6
India	10 10 0
Zinc dust	19 0 0
Zinc ashes	2 10 0
Off. aver., August	11 14 7½
Aver. spot, August	11 8 9½

LEAD.

	£ s. d.
Soft foreign ppt.	10 13 9
English	12 5 0
Off. average, August	11 19 4½
Average spot, August	11 18 10½

ZINC SHEETS, &c.

	£ s. d.
Zinc sheets, English	20 0 0
Do., V.M. ex-whf.	19 5 0
Rods	22 0 0
Boiler plates	14 12 6
Battery plates	16 5 0

ANTIMONY.

	£ s. d.
Special brand, Eng.	34 0 0
Chinese	21 15 0
Crude	20 0 0

QUICKSILVER.

	£ s. d.
Quicksilver	16 15 0

FERRO-ALLOYS AND STEEL-MAKING METALS.

Ferro-silicon—	
25%	£7 7 6
45/50%	£10 7 6
75%	£15 2 6
Ferro-vanadium—	
35/50%	12/8 lb. Va.
Ferro-molybdenum—	
70/75% c. free	4/2 lb. Mo.
Ferro-titanium—	
23/25% carbon-free	9½d. lb.
Ferro-phosphorus, 20/25%	£15 10 0
Ferro-tungsten—	
80/85%	1/8½ lb.
Tungsten metal powder—	
98/99%	1/11½ lb.
Ferro-chrome—	
2/4% car.	£27 10 0
4/6% car.	£21 2 6
6/8% car.	£20 10 0
8/10% car.	£19 15 0
Ferro-chrome—	
Max. 2% car.	£29 10 0
Max. 1% car.	£33 10 0
Max. 0·70% car.	£35 12 6
70% carbon-free	9¾d. lb.
Nickel—99% £170 0 0 to £175 0 0	
Ferro-cobalt	7/6 lb.
Aluminium 98/99%	£85 0 0
Metallic chromium—	
96/98%	2/7 lb.
Ferro-manganese (net)—	
76/80% loose £10 15 0 to £11 5 0	
76/80% packed £11 15 0 to £12 5 0	
76/80% export (nom.) £ 9 0 0	
Metallic manganese—	
94/96% carbon-free	1/3 lb.

Per ton unless otherwise stated.

HIGH-SPEED TOOL STEEL.

Finished bars, 14% tungsten	2s. 0d.
Finished bars, 18% tungsten	2s. 9d.

Per lb. net, d/d buyers' works.

Extras—	
Rounds and squares, 3 in. and over	4d. lb.
Rounds and squares, under ½ in. to ¼ in.	3d. lb.
Do., under ¼ in. to 3/16 in.	1/- lb.
Flats, ½ in. × ¼ in. to under 1 in. × ⅜ in.	3d. lb.
Do., under ½ in. × ¼ in.	1/- lb.
Bevels of approved sizes and sections	6d. lb.

Bars cut to length, 10% extra.

SCRAP.

South Wales	£ s. d.		£ s. d.
Heavy steel	1 18 0	to	2 0 0
Bundled steel and shrngs.	1 14 0	to	1 18 0
Mixed iron and steel	1 14 0	to	1 15 0
Heavy cast iron	2 1 0	to	2 2 0
Good machinery for foundries	2 5 0	to	2 7 6
Cleveland—			
Heavy steel	1 17 6		
Steel turnings	1 5 0		
Cast-iron borings	1 2 0		
Heavy forge	2 7 6		
W.I. piling scrap	2 2 6		
Cast-iron scrap	2 0 0	to	2 2 0
Midlands—			
Light cast-iron scrap	1 17 6		
Heavy wrought	2 5 0		
Steel turnings, f.o.r.	0 14 6		
Scotland—			
Heavy steel	1 17 6		
Ordinary cast iron	2 0 0		
Engineers' turnings	1 5 0		
Cast-iron borings	1 10 0		
Wrought-iron piling	2 5 0		
Heavy machinery	2 6 0		

London—Merchants' buying prices delivered yard.

	£ s. d.
Copper (clean)	25 0 0
Brass	18 0 0
Lead (less usual draft)	9 0 0
Tea lead	6 0 0
Zinc	4 10 0
New aluminium cuttings	52 0 0
Braziery copper	22 0 0
Gunmetal	22 0 0
Hollow pewter	76 0 0
Shaped black pewter	55 0 0

PIG-IRON.

(f.o.t. unless otherwise stated.)

N.E. Coast—	
Foundry No. 1	61/-
Foundry No. 3	58/6
Foundry No. 4	57/6
Forge No. 4	57/-
Hematite No. 1	60/6
Hematite M/Nos.	60/-
N.W. Coast—	
Hem. M/Nos. d/d Glas.	72/6
„ d/d Birm.	84/6
Malleable iron d/d Birm.	115/-
Midlands—	
Staffs common*	—
„ No. 4 forge*	61/-
„ No. 3 fdry.*	66/-
Shrops basic	—
„ Cold blast, ord.	—
„ „ roll iron	—
Northants forge*	57/6
„ fdry. No. 3*	62/6
„ fdry. No. 1*	65/6
Derbyshire forge*	61/-
„ fdry. No. 3*	66/-
„ fdry. No. 1*	69/-
„ basic*	—

*d/d Black Country dist.

Scotland—	
Foundry No. 1	72/-
„ No. 3	69/6
Hem. M/Nos. d/d	68/6
Sheffield (d/d district)—	
Derby forge	58/6
„ fdry. No. 3	63/6
Lincs forge	—
„ fdry. No. 3	63/6
E.C. hematite	75/6
W.C. hematite	81/6
Lancashire (d/d eq. Man.)—	
Derby forge	62/-
„ fdry. No. 3	67/-
Staffs fdry. No. 3	67/-
Northants fdry. No. 3	65/6
Cleveland fdry. No. 3	67/-
Dalzell, No. 3 (special)	102/6 to 105/-
Glengarnock, No. 3	86/- to 87/-
Clyde, No. 3	86/- to 87/-
Monkland, No. 3	86/- to 87/-
Summerlee, No. 3	86/- to 87/-
Eglinton, No. 3	86/- to 87/-
Gartsherrie, No. 3	86/- to 87/-
Shotts, No. 3	86/- to 87/-

FINISHED IRON AND STEEL.

Usual District deliveries for iron; delivered consumers' station for steel.

Iron—	£ s. d.		£ s. d.
Bars (cr.)	9 15 0	to	10 5 0
Nut and bolt iron	8 5 0	to	8 10 0
Hoops	10 10 0	to	12 0 0
Marked bars (Staffs) f.o.t.	12 0 0		
Gas strip	10 10 0	to	12 0 0
Bolts and nuts, ¾ in. × 4 in.	12 5 0		
Steel—			
Plates, ship, etc.	8 15 0	to	8 17 6
Boiler plts.	8 17 6	to	9 15 0
Chequer plts.	10 7 6		
Angles	8 7 6		
Tees	9 7 6		
Joists	8 15 0		
Rounds and squares, 3 in. to 5½ in.	9 7 6		
Rounds under 3 in. to ¾ in. (Untested)	6 12 6	& up.	
Flats—8 in. wide and over	8 12 6		
„ under 8 in. and over 5 in.	8 17 6		
Rails, heavy	8 5 0	to	8 10 0
Fishplates	12 0 0		
Hoops (Staffs)	9 5 0		
Black sheets, 24g.	7 15 0	to	8 5 0
Galv. cor. shts. 24g.	9 0 0		
Galv. flat sheets	9 10 0		
Galv. fencing wire, 8g. plain	11 0 0		
Billets, soft	4 17 6	to	5 5 0
Billets, hard	6 12 6		
Sheet bars	4 12 6	to	4 17 6
Tin bars	4 12 6		

PHOSPHOR BRONZE.

	Per lb. basis.
Strip	10½d.
Sheet to 10 w.g.	11¾d.
Wire	11¾d.
Rods	11¼d.
Tubes	1/6d.
Castings	11¾d.

Delivery 3 cwt. free.
10% phos. cop. £30 above B.S.
15% phos. cop. £35 above B.S.
Phosphor tin (5%) £30 above price of English ingots.
C. Clifford & Son, Limited.

NICKEL SILVER, &c.

	Per lb.
Ingots for raising	7d. to 1/1
Rolled—	
To 9 in. wide	1/1 to 1/7
To 12 in. wide	1/1½ to 1/7½
To 15 in. wide	1/1½ to 1/7½
To 18 in. wide	1/2 to 1/8
To 21 in. wide	1/2½ to 1/8½
To 25 in. wide	1/3 to 1/9
Ingots for spoons and forks	7d. to 1/3½
Ingots rolled to spoon size	10d. to 1/6½
Wire round—	
3/- to 10 g.	1/4½ to 1/11½

with extras according to gauge.
Special 5ths quality turning rods in straight lengths, 1/3½ upwards.

AMERICAN IRON AND STEEL.

At Pittsburgh unless otherwise stated.

	Dols.
No. 2 foundry, Phila.	16.76
No. 2 foundry, Valley	17.00
No. 2 foundry, Birm.	12.00
Basic	17.26
Bessemer	18.76
Malleable	18.76
Grey forge	18.26
Ferro-mang. 80%	85.00
O.-h. rails, h'y, at mill	43.00
Billets	29.00
Sheet bars	29.00
Wire rods	35.00
	Cents.
Iron bars, Phila.	2.09
Steel bars	1.60
Tank plates	1.65
Beams, etc.	1.65
Skelp, grooved steel	1.60
Skelp, sheared steel	1.65
Steel hoops	1.80
Sheets, black, No. 24	2.40
Sheets, galv., No. 24	2.90
Wire nails	1.90
Plain wire	2.20
Barbed wire, galv.	2.55
Tinplates, 100-lb. box	$5.00

COKE (at ovens).

Welsh foundry	22/6 to 25/-
„ furnace	14/- to 15/-
Durham and Northumberland—	
„ foundry	13/- to 14/-
„ furnace	13/-
Midlands, foundry	—
„ furnace	—

TINPLATES.

f.o.b. Bristol Channel ports.

I.C. cokes	20×14 box		13/- to 13/3
„	28×20	„	26/-
„	20×10	„	19/1½
„	18¾×14	„	14/-
C.W.	20×14	„	12/3
„	28×20	„	24/6
„	20×10	„	18/10½
„	18¾×14	„	14/-
Terneplates	28×20		25/6 per box basis f.o.b.

SWEDISH CHARCOAL IRON & STEEL.

Pig-iron	£6 0 0 to £7 0 0
Bars, hammered, basis	£16 10 0 to £17 0 0
Bars and nail-rods, rolled, basis	£15 17 6 to £16 5 0
Blooms	£10 0 0 to £12 0 0
Keg steel	£32 0 0 to £33 0 0
Faggot steel	£18 0 0 to £23 0 0
Bars and rods dead soft, st'l	£10 0 0 to £12 0 0

All per English ton, f.o.b. Gothenburg.

TUBES AND FITTINGS.

Current Discounts.

	Tubes.	*Fittings.*
Gas	62½%	57½%
Water	58½%	52½%
Steam	55%	47½%

W.I. 12½% extra.

DAILY FLUCTUATIONS.

Standard Copper (cash).

		£	s.	d.		
Sept.	3 ..	32	10	0	dec.	6/3
,,	4 ..	32	3	9	,,	6/3
,,	7 ..	31	10	0	,,	13/9
,,	8 ..	31	6	3	,,	3/9
,,	9 ..	30	11	3	,,	15/-

Electrolytic Copper.

		£	s.	d.		
Sept.	3 ..	36	0	0	inc.	5/-
,,	4 ..	35	0	0	dec.	20/-
,,	7 ..	35	0	0	No change	
,,	8 ..	35	0	0	,, ,,	
,,	9 ..	34	10	0	dec.	10/-

Standard Tin (cash).

		£	s.	d.		
Sept.	3 ..	117	10	0	dec.	15/-
,,	4 ..	115	7	6	,,	42/6
,,	7 ..	115	0	0	,,	7/6
,,	8 ..	114	10	0	,,	10/-
,,	9 ..	113	17	6	,,	12/6

Tin (English ingots).

		£	s.	d.		
Sept.	3 ..	119	0	0	dec.	20/-
,,	4 ..	117	0	0	,,	40/-
,,	7 ..	116	10	0	,,	10/-
,,	8 ..	116	0	0	,,	10/-
,,	9 ..	115	10	0	,,	10/-

Zinc Sheets (English).

		£	s.	d.		
Sept.	3 ..	20	0	0	No	change
,,	4 ..	20	0	0	,,	,,
,,	7 ..	20	0	0	,,	,,
,,	8 ..	20	0	0	,,	,,
,,	9 ..	20	0	0	,,	,,

Spelter (ordinary).

		£	s.	d.		
Sept.	3 ..	11	2	6	dec.	6/3
,,	4 ..	11	0	0	,,	2/6
,,	7 ..	11	2	6	inc.	2/6
,,	8 ..	11	1	3	dec.	1/3
,,	9 ..	10	15	0	,,	6/3

Lead (English).

		£	s.	d.		
Sept.	3 ..	12	10	0	No change	
,,	4 ..	12	10	0	,,	,,
,,	7 ..	12	10	0	,,	,,
,,	8 ..	12	5	0	dec.	5/-
,,	9 ..	12	5	0	No change	

AVERAGE MONTHLY PRICES OF STEEL RAILS.

Year.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Yearly average.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1916	10 19 4	11 0 0	11 0 0	10 18 9	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 9 10
1917	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6
1918	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6	10 17 6
1919	10 17 6	13 7 6	13 7 6	13 7 6	15 0 0	15 10 0	16 0 0	16 10 0	16 10 0	16 10 0	16 10 0	17 5 0	14 12 11
1920	18 15 0	19 5 0	20 7 6	22 0 0	23 0 0	23 0 0	24 0 0	25 0 0	25 0 0	25 0 0	25 0 0	25 0 0	22 18 11½
1921	23 5 0	20 4 0	18 0 0	17 0 0	15 0 0	15 0 0	14 0 0	14 0 0	14 0 0	11 12 6	10 10 0	10 0 0	15 4 3
1922	9 10 0	9 10 0	9 10 0	9 10 0	9 10 0	9 10 0	9 10 0	9 0 0	8 15 0	8 15 0	8 15 0	8 15 0	9 4 2
1923	8 17 6	9 2 0	10 5 0	10 10 0	10 10 0	10 10 0	9 15 0	9 0 0	8 15 0	8 15 0	8 19 0	9 5 0	9 9 10
1924	9 0 0	9 5 0	9 5 0	9 5 0	9 5 0	9 2 6	9 0 0	9 0 0	9 0 0	9 0 0	9 0 0	9 0 0	9 2 3½
1925	9 0 0	9 0 0	9 0 0	9 0 0	8 15 0	8 10 7½	8 10 0	8 10 0	8 10 0	8 4 0	8 0 0	8 0 0	8 11 7½
1926	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 0 0	8 7 6	8 10 0	8 10 0	8 10 0	8 10 0	8 3 11½
1927	8 10 0	8 10 0	8 10 0	8 2 6	8 2 6	8 2 6	8 2 6	8 2 6	8 2 6	8 3 0	8 5 0	8 5 0	8 4 10
1928	8 5 0	8 5 0	8 5 0	8 5 9	8 6 3	8 6 3	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 7 9½
1929	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0
1930	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0	8 10 0
1931	8 9 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	8 7 6	—	—	—	—	—

AVERAGE MONTHLY PRICES OF EAST COAST HEMATITE AT MIDDLESBROUGH.

Year.	Jan.	Feb.	March	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Average.
	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.	s. d.
1915	83 11	88 6	94 8	107 0	102 6	101 3	98 9	98 7½	96 6	104 0	124 1	130 0	106 11½
1916	133 9	140 0	136 6	122 6	122 6	122 6	122 6	122 6	122 6	122 6	122 6	122 6	128 1½
1917	122 6	122 6	122 6	122 6	122 6	122 6	122 6	122 6	122 6	122 6	122 6	122 6	122 6
1918	122 6	122 6	122 6	122 6	122 6	122 6	122 6	122 6	122 6	122 6	122 6	122 6	122 6
1919	122 6	122 6	122 6	122 6	179 2	190 0	197 6	200 0	200 0	200 0	200 0	200 0	171 4
1920	220 0	220 0	240 0	260 0	260 0	260 0	260 0	260 0	260 0	260 0	260 0	260 0	251 8
1921	240 0	220 0	180 0	180 0	180 0	160 0	160 0	160 0	137 0	127 6	117 6	104 6	162 2
1922	97 6	91 7½	100 0	98 6	97 1½	94 7	93 6	90 9	89 7	91 10½	93 0	93 2	94 5½
1923	94 6	104 9	122 0	126 10½	122 0	115 3	107 0	98 8½	98 10½	99 1½	100 6½	102 3	107 10½
1924	102 4½	101 3	99 7½	99 0	98 9½	97 4½	95 5½	93 1½	90 7½	88 0	88 4½	88 6	95 2½
1925	87 5	85 9	84 7½	82 6	80 10½	79 3	77 1½	75 7½	75 0	74 3½	74 9	76 0	79 5½
1926	77 3	77 9	77 3½	76 3	77 4½	78 0	79 8½	81 9	83 4½	87 7½	92 6	90 5½	81 7½
1927	90 0	90 0	86 3½	83 1½	80 6	78 0	76 6	75 4½	75 0	72 9	71 9	71 1½	79 2½
1928	69 7½	69 7½	69 9	70 0	70 0	69 3	68 7½	69 2	70 0	70 0	70 3	71 0	69 9½
1929	71 6	72 0	73 6	74 0	74 0	74 1½	74 9	75 8	76 1½	76 8½	78 1½	79 0	74 11½
1930	78 2½	78 0	76 9	75 0	74 0	72 7½	71 0	71 0	71 0	71 0	70 10½	70 4½	73 3½
1931	70 0	69 0	68 0	66 8½	65 1½	63 4½	62 9	61 1½	—	—	—	—	—

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13, RUMFORD STREET, LIVERPOOL.

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All grades FOUNDRY, HEMATITE, BASIC, SPECIALS, &c.

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WILLIAM JACKS & COMPANY,

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ZETLAND ROAD, MIDDLESBROUGH.

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(A remittance should accompany instructions.)

SITUATIONS VACANT AND WANTED.

ADVERTISER seeks work; last employed for 17 years with firm of motor cylinder and malleable ironfounders, in charge of correspondence and orders inwards and outwards; age 37.—Apply, Box 882, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

FOUNDRY Manager desires position. Modern experience, could introduce good paying speciality. (London district preferred.) Box 868, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

FOUNDRY Works Manager desires position, practical and technical training all branches grey iron, semi-steel, malleable iron, all non-ferrous metals. Have own mixing for and could introduce stainless steel, good knowledge of metallurgy, and mixing metals by analysis. Also experienced in engineering and pattern shop, good organiser, can get maximum production.—Box 872, Offices of THE FOUNDRY TRADES JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

AGENT, with good foundry connection West Riding, Yorkshire, for sale of Moulding Sands, etc. Commission basis. Existing connection handed over.—Fullest details, Box 876, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

EMPLOYMENT REGISTER.

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Any Member, Associate Member or Associate of the Institute of British Foundrymen who desires his qualifications to be inserted in the column must forward to the General Secretary of the Institute the following information:—(a) Name and address; (b) name of present employer (or last employer if unemployed); (c) brief particulars of qualifications, experience, and type of position required. The name will not be disclosed until the candidate is in communication with a prospective employer. Announcements will be inserted in two successive issues, unless announcers' requirements have been met with in the meantime.

Any employer wishing to communicate with a candidate should write to the General Secretary, quoting identification number.

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YOUNG Steel Moulder with sound, up-to-date experience, requires supervisory position. Knowledge of quoting, piecework or day-work. (141)

ENGINEERING and Repairing Works Manager requires similar position or as Representative. Works, drawing office, and commercial training. Has held present post as works manager for several years. Excellent commercial connection. (142)

NOTICE.

CITY OF LONDON.

THE SIR JOHN CASS TECHNICAL INSTITUTE.

Jewry Street, Aldgate, E.C.3.

DEPARTMENT OF METALLURGY.

The following course of instruction will be given during the Session 1931-32, commencing September 21, at 7 p.m.

FOUNDRY PRACTICE.

By A. F. GIBBS.

This course is arranged for those who wish to take the official examination in Foundry Practice and Science held by the City and Guilds of London Institute, in conjunction with the Institute of British Foundrymen; for those who wish to take the examination in Foundry Practice to have their National Certificate in Mechanical Engineering endorsed to that effect; and also for those in the Metallurgical and Allied Industries who wish to obtain a knowledge of Foundry Work.

Full particulars of the above course and also of the general courses given in the Department of Metallurgy may be obtained on application to

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145,000 Sq. Ft. of Shops.

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WELL-BUILT & COMMODIOUS OFFICES

Will Sell whole or in lots to suit customers or Let on favourable terms. Unique opportunity for Manufacturers.

Apply—

THOS. W. WARD, LTD.,
ALBION WORKS, SHEFFIELD.

FOR Sale.—Modern London Iron Foundry with railway siding facilities, on acre of land. Electric power and small machine shop suitable for castings up to 3 tons in weight. capacity 20 tons per week. Overhead crane and all equipment.—Box 878, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

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THOS. W. WARD, LTD.

2,000 cub. ft. Motor-driven Air Compressor, 120 lbs. pressure, driven by 430-h.p. 440-volt A.C. Motor.

WORTHINGTON 8-in. x 12-in. Horizontal Treble Ram Pump.

New 15-b.h.p. Heavy Fuel Oil Engine, from stock.

5-kw. PETTER Oil-engine-driven Generating Set, 110 volts.

Two 7/5 "Ransome" Light-weight CONCRETE MIXERS, 3-h.p. Petrol Engine, on road wheels.

Three ¼-cub.-yd. "Millars-Jaeger" CONCRETE MIXERS, 3-h.p. Petrol Engines, on road wheels.

Two 5-DRUM STIRLING WATER-TUBE BOILERS, each of 7,068 sq. ft. of heating surface, for 160 lbs. per sq. in. working pressure.

Large number of SAFES, all sizes.

(ASK FOR "ALBION" MACHINERY CATALOGUE.)

ALBION WORKS, SHEFFIELD.

MACHINERY—*Continued.*

SAND MIXERS.—New and Secondhand. Ask us to quote.—W. BREALEY & COMPANY, LIMITED, Station Works, Ecclesfield, Sheffield.

AIR COMPRESSORS of all sizes in stock, suitable to drive moulding machines; Air Compressors for sand-blast plants; please state your wants.—A. HAMMOND, Foundry Machinery Merchant, 14, Australia Road, Slough.

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OLD-ESTABLISHED FIRM, manufacturing Foundry supplies and equipment, for sale, through owner going abroad. Price £3,000. Splendid business. An incoming party can make a substantial income. Principals only.—Box 884, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

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GANISTER, best quality for cupolas, also for Steel Works.—ASTBURY SILICA COMPANY, "The Brooms," Park Lane, Congleton.

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CUPOLA re-lined week-ends; instruction given on brick fettling; also tapholes trouble, etc., remedy by practical man; prices according to size.—Box 880, Offices of THE FOUNDRY TRADE JOURNAL, 49, Wellington Street, Strand, London, W.C.2.

'Phone: 287 SLOUGH

SAND PLANT

IN STOCK

Small Jackman SM4 Aerator...	£12
"Herbert" Mixer, as new ...	£32
All above BALL BEARING.	
3 ft. 6 in. "Evans" Sandmill	£15
4 ft. 6 in. "Evans" Sandmill ...	£20
6 ft. "Jackman" Sandmill ...	£38
Jackman Rotary Sifter	£8
No. 3 "Rotoil" Mixer, new condition	£50

BUY FROM ME AND SAVE MONEY!

ALEX. HAMMOND, *Foundry Machinery Merchant,*
14, AUSTRALIA ROAD, SLOUGH

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REFINED

PIG IRONS

give consistently high tensile and transverse tests and possess all those inherent properties which go to make sound, strong and perfect castings.

Full particulars of the Bradley Mixture Service are contained in an interesting booklet, a copy of which will be sent free on request.

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